



State of Utah

GARY R. HERBERT
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Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

4/007/039 Incoming
cc: Steve C.
Amanda

AUG 26 2015

CERTIFIED MAIL
(Return Receipt Requested)

William King, Environmental Engineer
Canyon Fuel Company, LLC-Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Dear Mr. King:

Subject: UPDES Permit UT0025593, Canyon Fuel Company, LLC-Dugout Canyon Mine

Enclosed is UPDES Permit No. UT0025593 for your facility. Copies of EPA form 3320-1, Discharge Monitoring Report (DMR) forms, for reporting and self-monitoring requirements as specified in the permit, can be sent via e-mail, if requested. This permit will become effective on September 1, 2015, subject to the right of appeal in accordance with the provisions of *Utah Administrative Code*, Section R317-9.

As the State agency charged with the administration of issuing UPDES Permits, we are continuously looking for ways to improve our quality of service to you. In effort to improve the State UPDES permitting process we are asking for your input. Since our customer permittee base is limited, your input is important. Please take a few moments to complete an online survey (Go to www.waterquality.utah.gov and click on the 'Give Feedback to DWQ' button on the left side of page.) The results will be used to improve our quality and responsiveness to our permittees and give us feedback on customer satisfaction. We will address the issues you have identified on an ongoing basis.

If you have any questions regarding this matter, please contact Ken Hoffman at (801) 536-4313 or kenhoffman@utah.gov.

Sincerely,



Kim Shelley, Manager
Surface Water Section

KS:KH:ph

Enclosures (4):

1. Fact Sheet, (DWQ-2014-0015861)
2. Waste Load Analysis, (DWQ-2014-016399)
3. Permit, (DWQ-2014-015862)
4. Antidegradation Review Form (DWQ-2015-006804)

cc: Amy Clark, EPA Region VIII (W/encl)
Brady Bradford, Southeastern Utah District Health Department
David Ariotti, DEQ District Engineer
Dana Dean, DOGM
Greg Sheehan, Utah Division of Wildlife Resources (w/o encl)
Chris Cline, U.S. Fish & Wildlife Services (w/o encl)
Jason Gipson, Chief, Utah Regulatory Office, U.S. Corps
Of Engineers (w/o encl)

DWQ-2015-009464

**FACT SHEET STATEMENT OF BASIS
CANYON FUEL COMPANY, LLC
DUGOUT CANYON MINE
MINOR INDUSTRIAL RENEWAL PERMIT
UPDES PERMIT No. UT0025593**

CONTACT: William King, Environmental Engineer
Canyon Fuel Company, LLC
P. O. Box 1029
Wellington, Utah 84542
Phone: (435) 636-2898

DESCRIPTION OF FACILITY AND DISCHARGE

The Canyon Fuel Company's Dugout Canyon Mine (Dugout) is an active underground coal mine operation with *Standard Industrial Classification 1222, for bituminous underground coal mining operations*. The facility is located approximately 12 ½ miles northeast of Wellington, Utah in Dugout Canyon off Nine Mile Canyon Road. It has a total of six permitted discharge points (Outfalls 001 thru 006). Outfalls 001 and 005 are mine water discharges which go to Dugout Creek and Pace Canyon Creek, respectively and are the main discharges from Dugout. Outfall 002 is from a sedimentation pond which collects surface water runoff from the main facility in Dugout Canyon and discharges to Dugout Creek once a year on average during cleaning and maintenance of the pond. Outfall 003 is from a water storage tank that intermittently discharges to Dugout Creek when full. Outfall 004 is from a sedimentation pond at the waste rock disposal site, which has not discharged to date and is not expected to discharge due to its size. If a discharge were to occur, it would go to an unnamed tributary of Grassy Trail Creek. Outfall 006, which has also not discharged to date, is from a sediment pond trap that collects surface water runoff from the Pace Canyon fan portal breakout facility and would discharge to Pace Canyon Creek. Outfall 007 is from a sedimentation pond at the waste rock disposal site, which has not yet been constructed and is not expected to discharge due to the pond retention size.

In a letter dated December 8, 2014 to DWQ, Dugout requested an additional UPDES outfall. This request is due to the need to construct a new sediment pond for additional waste rock disposal capacity. The design and construction of this pond and additional capacity will be permitted with and overseen by, the Utah Division of Oil Gas and Mining (DOGM), in accordance with the Surface Mining Control and Reclamation Act (SMCRA). The effluent limitations for Outfall 007 will be the same as Outfall 004.

RECEIVING WATERS AND STREAM CLASSIFICATIONS

Dugout Creek is the receiving water for outfalls 001, 002, and 003. An unnamed tributary to Grassy Trail Creek is the receiving water for 004 and 007. Outfalls 005 and 006 discharge to Pace Canyon Creek. The classifications for these receiving waters are as follows:

Class 2B – protected for secondary contact recreation such as boating, wading, or similar uses.

Class 3C – protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.

Class 4 – protected for agricultural uses including irrigation of crops and stock watering.

DISCHARGE MONITORING RESULTS

The discharge monitoring results (DMRs) for the past 5 years were reviewed. Nine effluent limitation exceedances were reported. No enforcement actions were taken on these exceedances since they occurred over numerous years, some were in relation to very large storm events and Dugout Canyon Mine has been responsive to the events.

Monitoring Period	Outfall	Parameter	Limit type	Limit (mg/L)	Reported Value (mg/L)
June 2009	001A	Total Iron	Daily Max	1.1	1.6
October 2010	005A	Total Iron	Daily Max	1.1	3.4
November 2010	005A	TDS	Daily Max	2,400	4,080
January 2011	005A	Total Iron	Daily Max	1.1	1.7
January 2011	005A	TDS	Daily Max	2,400	3,710
September 2013	002A	Total Iron	Daily Max	1.1	1.46
September 2013	002A	TSS	Daily Max	70	87
			7 day Max	35	68
			30 day average Max	25	38.75

BASIS FOR EFFLUENT LIMITATIONS

In accordance with regulations promulgated in *40 Code of Federal Regulations (CFR) Part 122.44* and in *UAC R317-8-4.2*, effluent limitations are derived from technology-based effluent limitations guidelines, Utah Secondary Treatment Standards (*UAC R317-1-3.2*) or Utah Water Quality Standards (*UAC R317-2*). In cases where multiple limits have been developed, those that are more stringent apply. In cases where no limits have been developed, Best Professional Judgment (BPJ) may be used where applicable. “Best Professional Judgment” refers to the method used by permit writers to develop technology-based UPDES conditions on a case-by-case basis using all reasonably available and relevant data.

The following is a list of the basis for effluent limitations:

- 1) Since the Dugout discharge meets the EPA definition of “alkaline mine drainage,” the permittee is subject to the technology based effluent limitations in *40 CFR Part 434.45*. Applicable technology based limits included in the permit are as follows:
 - a. Total suspended solids (TSS) daily maximum limit of 70 mg/L.
 - b. For discharges composed of surface water or mine water commingled with surface water, *40 CFR Part 434.63* allows alternate effluent limits to be applied when discharges result from specific runoff events, detailed below and

in the permit. Dugout has the burden of proof that the described runoff event occurred as described in the permit.

- i. For runoff events (rainfall or snowmelt) less than or equal to a 10-year 24-hour precipitation event, settleable solids may be substituted for TSS and shall be limited to 0.5 milliliters per liter (ml/L). All other effluent limitations must be achieved concurrently, as described in the permit.
- 2) TSS 30-day and 7-day averages are based on Utah Secondary Treatment Standards.
- 3) Daily minimum and daily maximum limitations on pH are derived from Utah Secondary Treatment Standards and Water Quality Standards.
- 4) Total dissolved solids (TDS) are limited by both mass loading and concentration requirements as indicated below:
 - a. Since discharges from Dugout eventually reach the Colorado River, TDS mass loading is limited according to policies established by the Colorado River Basin Salinity Control Forum (Forum), as authorized in *UAC R317-2-4* to further control salinity in the Utah portion of the Colorado River Basin. On February 28, 1977, the Forum produced the "*Policy For Implementation of Colorado River Salinity Standards Through the NPDES Permit Program*" (Policy), with the most current subsequent triennial revision dated October 2008. Based on Forum Policy, the TDS shall be limited to one-ton per day as a sum of all discharge points, unless provisions are made for salinity-offset projects to account for any TDS loading in excess of the one-ton per day requirement. Salinity-offset provisions have previously been included in Dugout's permit as the facility remains current on the requirements included therein to account for all TDS loading in excess of one-ton per day. These provisions and requirements, as described further in both the permit and in a latter section of this fact sheet statement of basis, will remain in Dugout's renewal permit as appropriate.
 - b. TDS concentrations are limited by Water Quality Standards in *UAC R317-2-14*, which includes site specific criterion for impaired water bodies as developed through the total maximum daily load (TMDL) process. Although a TMDL standard has previously been established with a site specific TDS effluent limit of 3000 mg/L for point source discharges, as taken from the *Price River, San Rafael River and Muddy Creek TMDLs for Dissolved Solids – West Colorado Watershed Management Unit, Utah April 2004, p. A-25, Table A-12*, previous discharge TDS data from Dugout indicates that the permittee will be able to comply with the existing and more stringent limitation of 2,400 mg/L. Therefore based on BPJ, the TDS concentration limit of 2,400 mg/L for all discharge points will be retained in this renewal permit.
- 5) Limitation on flow is water quality based as presented in the Waste Load Analysis (WLA), which is described further in the following section.

- 6) Limitation on total iron is water quality based as presented in the WLA and a BPJ decision. The resulting total iron effluent limitation based on the 2014 WLA was 1.0 mg/L, however previous WLA resulting total iron effluent limitation were 1.1 mg/L. The 1.1 mg/L effluent limitation has been in place for the past 10 years and has been protective of environmental impacts. Based on BPJ of the permit writer, which included discussions with the waste load analyst, the total iron effluent limitation will be held at the previous permit effluent limitation of 1.1 mg/L.
- 7) Oil and Grease concentrations are limited to 10 mg/L by BPJ to be consistent with other industrial facilities statewide.

WASTE LOAD ANALYSIS AND ANTIDEGRADATION REVIEW

Effluent limitations are also derived using a waste load analysis (WLA), which is appended to this statement of basis. The WLA incorporates Secondary Treatment Standards, Water Quality Standards, Antidegradation Reviews (ADR), as appropriate and designated uses into a water quality model that projects the effects of discharge concentrations on receiving water quality. Effluent limitations are those that the model demonstrates are sufficient to meet State water quality standards in the receiving waters. During this UPDES renewal permit development, a WLA and ADR were performed. An ADR Level I review was performed and concluded that an ADR Level II review was not required. The WLA indicates that the effluent limitations should be sufficiently protective of water quality, in order to meet State water quality standards in the receiving waters. The discharge was evaluated and determined not to cause a violation of State Water Quality Standards in downstream receiving waters.

EFFLUENT LIMITS & SELF-MONITORING & REPORTING REQUIREMENTS

Dugout is expected to be able to continue complying with the following effluent limitations and self-monitoring and reporting requirements for Outfalls 001-007, as described below.

Parameter, Units	Effluent Limitations <u>a/</u>			
	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum
Total Effluent Flow, MGD, <u>b/</u>	2.0			Report
Total Iron, mg/L				1.1
Total Suspended Solids (TSS), mg/L	25	35		70
Total Dissolved Solids (TDS), mg/L, <u>c/</u>	Report			2,400
TDS, tons/day, <u>c/</u>				1.0
pH, Standard Units(SU)			6.5	9.0
Oil & Grease, mg/L, <u>d/</u>				10

mg/L – milligrams per liter;

MGD – million gallons per day

Discharge monitoring report (DMR) forms shall be submitted on a monthly basis and are due on or before the 28th day of the month after each monitoring period. For example, the DMR

form for February would be due by March 28th. A review of the past 5 years of DMR data reveals that Dugout has exceeded a few permit limitations but should be able to continue complying with the permit provisions herein. DMR data from 2008 were compiled and included as an attachment to this fact sheet statement of basis.

Listed below are the permit parameters and the associated sampling frequency, type of sample and required units, followed by the applicable permit footnotes as appropriate.

Self-Monitoring and Reporting Requirements <u>a/</u>			
Parameter	Frequency	Sample Type	Units
Total Flow, <u>b/</u>	Continuous/ Twice Monthly	Recorder/ Measured	MGD
Total Iron	Twice Monthly	Grab	mg/L
TSS	Twice Monthly	Grab	mg/L
TDS, <u>c/</u>	Twice Monthly	Grab	mg/L & tons/day
pH	Twice Monthly	Grab	SU
Oil & Grease, <u>d/</u>	Twice Monthly	Visual, Grab	Yes/No, mg/L

There shall be no visible sheen or floating solids or visible foam in other than trace amounts upon any discharges and there shall be no discharge of any sanitary wastes at any time.

a/ See Definitions, *Part I.A* of the permit, for definition of terms.

b/ The maximum monthly average of 2.0 MGD applies to outfall 001 only. The remaining outfalls shall report the maximum monthly average upon discharging. Flows from outfalls 001 and 005 shall be from a continuous recorder. Flows from the remaining outfalls shall be from either a continuous recorder, or measured at least twice per month upon discharging. If the rate of discharge is controlled, such as from intermittent discharging outfalls, the rate and duration of discharge shall be reported.

c/ The TDS concentration from each of the outfalls shall not exceed 2400 mg/L as a daily maximum limit. No tons per day loading limit will be applied if the concentration of TDS in the discharge is equal to or less than 500 mg/L as a thirty-day average. However, if the 30-day average concentration exceeds 500 mg/L, then the permittee cannot discharge more than 1.0 ton per day as a sum from all discharge points. As previously determined by the Director, the permittee is not able to meet the 500 mg/L 30-day average or the 1.0 ton per day loading limit. The permittee is required to continue to participate in and/or fund a salinity offset project to include the TDS offset credits as appropriate.

The salinity-offset project shall include TDS credits on a ton-for-ton basis for which the permittee is over the 1.0 ton per day loading limit. The tonnage reduction from the offset project must be calculated by a method similar to one used by the NRCS, Colorado River Basin Salinity Control Forum, or other applicable agency.

If the permittee will be participating in the construction and implementation of a new salinity-offset project, then a project description and implementation schedule shall be submitted to the Director at least six (6) months prior to the implementation date of the project, which will then be reviewed for approval. The salinity offset project description and implementation schedule must be approved by the Director and shall be appended to this permit.

If the permittee will be funding any additional salinity-offset projects through third parties, the permittee shall provide satisfactory evidence to the Director that the required funds have been deposited to the third party within six (6) months of project approval by the Director. A monitoring and adjustment plan to track the TDS credits shall continue to be submitted to the Director for each monthly monitoring period during the life of this permit. Any changes to the monitoring and adjustment plan must be approved by the Director and upon approval shall be appended to this permit.

d/ Oil and grease monitoring shall initially be a visual test. If any oil and/or grease sheens are observed visually, or there is any other reason to believe that oil and/or grease may be present in the discharge, then a grab sample of the effluent must be immediately taken and this sample shall not exceed 10 mg/L.

SIGNIFICANT CHANGES FROM PREVIOUS PERMIT

Outfall 007 has been added during this permit renewal. There are no other significant changes being proposed to the existing permit.

PRETREATMENT REQUIREMENTS

This facility does not discharge process wastewater to a sanitary sewer system. Any process wastewater that the facility may discharge to the sanitary sewer, either as a direct discharge or as a hauled waste, is subject to federal, state, and local pretreatment regulations. Pursuant to section 307 of the Clean Water Act, the permittee shall comply with all applicable federal general pretreatment regulations promulgated, found in 40 CFR 403, the state's pretreatment requirements found in UAC R317-8-8, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the waste.

BIOMONITORING REQUIREMENTS

As part of a nationwide effort to control toxic discharges, biomonitoring requirements are being included in permits for facilities where effluent toxicity is an existing or potential concern. In Utah, this is done in accordance with the State of Utah's "*UPDES Permitting and Enforcement Guidance Document for Whole Effluent Toxicity (WET) Control (Biomonitoring)*, Division of Water Quality, March 1999." Authority to require effluent biomonitoring is provided in UAC R317-8, *Utah Pollutant Discharge Elimination System and UAC R317-2, Water Quality Standards*.

The permittee is not classified as a major facility or a significant minor facility and discharges from Dugout are from intercepted ground water and/or storm water only, in which toxicity has not been an existing or a potential concern. Discharges are to ephemeral drainages and do not

normally reach down stream waters, but are rather utilized in full by local farming and ranching practices. However, upon request from DWQ and during the development of the previous permit, the permittee performed Acute Biomonitoring WET testing, using the appropriate test species and methods, resulting in no acute toxicity.

This information, along with the fact that the mine water discharges have previously and consistently been used for local irrigation and stock watering practices with no observable or reported ill effects, brings the conclusion that no toxicity is present in the effluent. Based on these considerations, there is no reasonable potential for toxicity in the facility's discharge (*per State of Utah's UPDES Permitting and Enforcement Guidance Document for WET Control*). As such, there will be no numerical WET limitations or WET monitoring requirements in this permit. However, the permit will contain a toxicity limitation re-opener provision that allows for modification of the permit at any time in the future should additional information indicate the presence of toxicity in the discharge.

STORMWATER REQUIREMENTS

The storm water requirements are based on the UPDES Multi-Sector General Permit for Storm Water Discharges for Industrial Activity, General Permit No. UTR000000 (MSGP). Sections of the MSGP that pertain to discharges from an industrial activity have been included and sections which are redundant or do not pertain have been deleted.

The permit requires the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for all areas associated with the facility. The SWPPP must be updated regularly and when storm water-related or effluent-related changes occur on the property. The SWPPP elements of this plan are required to include: 1) the development of a pollution prevention team, 2) development of drainage maps and materials stockpiles, 3) an inventory of exposed materials, 4) spill reporting and response procedures, 5) a preventative maintenance program, 6) employee training, 7) certification that storm water discharges are not mixed with non-storm water discharges, 8) compliance site evaluations and potential pollutant source identification, and 9) visual examinations of storm water discharges. The SWPPP is maintained on site and is available for review during inspections.

PERMIT DURATION

As stated in *UAC R317-8-5.1(1)*, UPDES permits shall be effective for a fixed term not to exceed five (5) years.

Drafted by:
Permit Writer
WET
Stormwater
TMDL
WLA

Ken Hoffman, P.E. 801-536-4313 (kenhoffman@utah.gov)
Mike Herkimer
Mike George
Amy Dickey
Dave Wham

PUBLIC COMMENT

Began: June 25, 2015

Ended: July 27, 2015

Public Noticed in the Sun-Advocate

No comments were received during the public notice period; therefore the permit is the same as the public notice draft.

Utah Division of Water Quality
Salt Lake City, Utah

WASTELOAD ANALYSIS [WLA]
Addendum: Statement of Basis
SUMMARY

Discharging Facility: Canyon Fuel Dugout Mine / Dugout Creek

UPDES No: UT-UT0023540

Current Flow: 2.00 MGD Design Flow

Design Flow 2.00 MGD

Receiving Water: Dugout Creek

Stream Classification: 2B, 3C, 4

Stream Flows [cfs]: 0.000 Summer (July-Sept) 20th Percentile

0.000 Fall (Oct-Dec) 20th Percentile

0.000 Winter (Jan-Mar) 20th Percentile

0.000 Spring (Apr-June) 20th Percentile

0.36 Average

Stream TDS Values: 400.0 Summer (July-Sept) 80th Percentile

400.0 Fall (Oct-Dec) 80th Percentile

400.0 Winter (Jan-Mar) 80th Percentile

400.0 Spring (Apr-June) 80th Percentile

Effluent Limits:

Flow, MGD: 2.00 MGD Design Flow

BOD, mg/l: 25.0 Summer 5.0 Indicator

Dissolved Oxygen, mg/l: 5.0 Summer 5.0 30 Day Average

TNH₃, Chronic, mg/l: 3.4 Summer Varies Function of pH and Temperature

TDS, mg/l: 3000.1 Summer 3000.0 Site Specific

WQ Standard:

Modeling Parameters:

Acute River Width: 50.0%

Chronic River Width: 100.0%

Level 1 Antidegradation Level Completed: Level II Review not required

Date: 10/16/2014

Permit Writer:

WLA by:

WQM Sec. Approval:

TMDL Sec. Approval:

[Signature]

10-21-14

**Utah Division of Water Quality
Salt Lake City, Utah**

**WASTELOAD ANALYSIS [WLA]
Addendum: Statement of Basis**

16-Oct-14
4:00 PM

Facilities: Canyon Fuel Dugout Mine / Dugout Creek
Discharging to: Dugout Creek

UPDES No: UT-UT0023540

I. Introduction

Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses [R317-2-8, UAC]. Projected concentrations are compared to numeric water quality standards to determine acceptability. The anti-degradation policy and procedures are also considered. The primary in-stream parameters of concern may include metals (as a function of hardness), total dissolved solids (TDS), total residual chlorine (TRC), un-ionized ammonia (as a function of pH and temperature, measured and evaluated in terms of total ammonia), and dissolved oxygen.

Mathematical water quality modeling is employed to determine stream quality response to point source discharges. Models aid in the effort of anticipating stream quality at future effluent flows at critical environmental conditions (e.g., low stream flow, high temperature, high pH, etc).

The numeric criteria in this wasteload analysis may always be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

II. Receiving Water and Stream Classification

Dugout Creek:	2B, 3C, 4
Antidegradation Review:	Level I review completed. Level II review not required.

III. Numeric Stream Standards for Protection of Aquatic Wildlife

Total Ammonia (TNH3)	Varies as a function of Temperature and pH Rebound. See Water Quality Standards	
Chronic Total Residual Chlorine (TRC)	0.011 mg/l (4 Day Average) 0.019 mg/l (1 Hour Average)	
Chronic Dissolved Oxygen (DO)	5.00 mg/l (30 Day Average) N/A mg/l (7Day Average) 3.00 mg/l (1 Day Average)	
Maximum Total Dissolved Solids	3000.0 mg/l	3ackground

**Utah Division of Water Quality
Salt Lake City, Utah**

Acute and Chronic Heavy Metals (Dissolved)

Parameter	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard		
	Concentration	Load*	Concentration		Load*
Aluminum	87.00 ug/l**	0.141 lbs/day	750.00	ug/l	1.213 lbs/day
Arsenic	190.00 ug/l	0.307 lbs/day	340.00	ug/l	0.550 lbs/day
Cadmium	0.61 ug/l	0.001 lbs/day	6.52	ug/l	0.011 lbs/day
Chromium III	211.92 ug/l	0.343 lbs/day	4433.71	ug/l	7.169 lbs/day
Chromium VI	11.00 ug/l	0.018 lbs/day	16.00	ug/l	0.026 lbs/day
Copper	23.85 ug/l	0.039 lbs/day	39.41	ug/l	0.064 lbs/day
Iron			1000.00	ug/l	1.617 lbs/day
Lead	12.88 ug/l	0.021 lbs/day	330.60	ug/l	0.535 lbs/day
Mercury	0.0120 ug/l	0.000 lbs/day	2.40	ug/l	0.004 lbs/day
Nickel	132.13 ug/l	0.214 lbs/day	1188.44	ug/l	1.922 lbs/day
Selenium	4.60 ug/l	0.007 lbs/day	20.00	ug/l	0.032 lbs/day
Silver	N/A ug/l	N/A lbs/day	25.04	ug/l	0.040 lbs/day
Zinc	303.93 ug/l	0.491 lbs/day	303.93	ug/l	0.491 lbs/day

* Allowed below discharge

**Chronic Aluminum standard applies only to waters with a pH < 7.0 and a Hardness < 50 mg/l as CaCO₃

Metals Standards Based upon a Hardness of 300 mg/l as CaCO₃

Organics [Pesticides]

Parameter	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard		
	Concentration	Load*	Concentration		Load*
Aldrin			1.500	ug/l	0.002 lbs/day
Chlordane	0.004 ug/l	0.072 lbs/day	1.200	ug/l	0.002 lbs/day
DDT, DDE	0.001 ug/l	0.017 lbs/day	0.550	ug/l	0.001 lbs/day
Dieldrin	0.002 ug/l	0.032 lbs/day	1.250	ug/l	0.002 lbs/day
Endosulfan	0.056 ug/l	0.934 lbs/day	0.110	ug/l	0.000 lbs/day
Endrin	0.002 ug/l	0.038 lbs/day	0.090	ug/l	0.000 lbs/day
Guthion			0.010	ug/l	0.000 lbs/day
Heptachlor	0.004 ug/l	0.063 lbs/day	0.260	ug/l	0.000 lbs/day
Lindane	0.080 ug/l	1.334 lbs/day	1.000	ug/l	0.002 lbs/day
Methoxychlor			0.030	ug/l	0.000 lbs/day
Mirex			0.010	ug/l	0.000 lbs/day
Parathion			0.040	ug/l	0.000 lbs/day
PCB's	0.014 ug/l	0.233 lbs/day	2.000	ug/l	0.003 lbs/day
Pentachlorophenol	13.00 ug/l	216.804 lbs/day	20.000	ug/l	0.032 lbs/day
Toxophene	0.0002 ug/l	0.003 lbs/day	0.7300	ug/l	0.001 lbs/day

**Utah Division of Water Quality
Salt Lake City, Utah**

IV. Numeric Stream Standards for Protection of Agriculture

	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
	Concentration	Load*	Concentration	Load*
Arsenic			100.0 ug/l	lbs/day
Boron			750.0 ug/l	0.61 lbs/day
Cadmium			10.0 ug/l	0.01 lbs/day
Chromium			100.0 ug/l	lbs/day
Copper			200.0 ug/l	lbs/day
Lead			100.0 ug/l	lbs/day
Selenium			50.0 ug/l	lbs/day
TDS, Summer			3000.0 mg/l	2.43 tons/day

V. Numeric Stream Standards for Protection of Human Health (Class 1C Waters)

	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
	Concentration	Load*	Concentration	Load*
Metals				
Arsenic			50.0 ug/l	0.834 lbs/day
Barium			1000.0 ug/l	16.677 lbs/day
Cadmium			10.0 ug/l	0.167 lbs/day
Chromium			50.0 ug/l	0.834 lbs/day
Lead			50.0 ug/l	0.834 lbs/day
Mercury			2.0 ug/l	0.033 lbs/day
Selenium			10.0 ug/l	0.167 lbs/day
Silver			50.0 ug/l	0.834 lbs/day
Fluoride (3)			1.4 ug/l	0.023 lbs/day
to			2.4 ug/l	0.040 lbs/day
Nitrates as N			10.0 ug/l	0.167 lbs/day

Chlorophenoxy Herbicides

2,4-D	100.0 ug/l	1.668 lbs/day
2,4,5-TP	10.0 ug/l	0.167 lbs/day
Endrin	0.2 ug/l	0.003 lbs/day
ocyclohexane (Lindane)	4.0 ug/l	0.067 lbs/day
Methoxychlor	100.0 ug/l	1.668 lbs/day
Toxaphene	5.0 ug/l	0.083 lbs/day

VI. Numeric Stream Standards the Protection of Human Health from Water & Fish Consumption [Toxics]

	Maximum Conc., ug/l - Acute Standards			
	Class 1C		Class 3A, 3B	
	[2 Liters/Day for 70 Kg Person over 70 Yr.]		[6.5 g for 70 Kg Person over 70 Yr.]	
Toxic Organics				
Acenaphthene	1200.00 ug/l	20.01 lbs/day	2700.0 ug/l	45.03 lbs/day
Acrolein	320.00 ug/l	5.34 lbs/day	780.0 ug/l	13.01 lbs/day
Acrylonitrile	0.06 ug/l	0.00 lbs/day	0.7 ug/l	0.01 lbs/day
Benzene	1.20 ug/l	0.02 lbs/day	71.0 ug/l	1.18 lbs/day
Benzidine	0.00012 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Carbon tetrachloride	0.25 ug/l	0.00 lbs/day	4.4 ug/l	0.07 lbs/day
Chlorobenzene	680.00 ug/l	11.34 lbs/day	21000.0 ug/l	350.22 lbs/day
1,2,4-Trichlorobenzene				
Hexachlorobenzene	0.00075 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
1,2-Dichloroethane	0.38 ug/l	0.01 lbs/day	99.0 ug/l	1.65 lbs/day

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1,1,1-Trichloroethane				
Hexachloroethane	1.90 ug/l	0.03 lbs/day	8.9 ug/l	0.15 lbs/day
1,1-Dichloroethane				
1,1,2-Trichloroethane	0.61 ug/l	0.01 lbs/day	42.0 ug/l	0.70 lbs/day
1,1,2,2-Tetrachloroethane	0.17 ug/l	0.00 lbs/day	11.0 ug/l	0.18 lbs/day
Chloroethane			0.0 ug/l	0.00 lbs/day
Bis(2-chloroethyl) ether	0.03 ug/l	0.00 lbs/day	1.4 ug/l	0.02 lbs/day
2-Chloroethyl vinyl ether	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
2-Chloronaphthalene	1700.00 ug/l	28.35 lbs/day	4300.0 ug/l	71.71 lbs/day
2,4,6-Trichlorophenol	2.10 ug/l	0.04 lbs/day	6.5 ug/l	0.11 lbs/day
p-Chloro-m-cresol			0.0 ug/l	0.00 lbs/day
Chloroform (HM)	5.70 ug/l	0.10 lbs/day	470.0 ug/l	7.84 lbs/day
2-Chlorophenol	120.00 ug/l	2.00 lbs/day	400.0 ug/l	6.67 lbs/day
1,2-Dichlorobenzene	2700.00 ug/l	45.03 lbs/day	17000.0 ug/l	283.51 lbs/day
1,3-Dichlorobenzene	400.00 ug/l	6.67 lbs/day	2600.0 ug/l	43.36 lbs/day
1,4-Dichlorobenzene	400.00 ug/l	6.67 lbs/day	2600.0 ug/l	43.36 lbs/day
3,3'-Dichlorobenzidine	0.04 ug/l	0.00 lbs/day	0.1 ug/l	0.00 lbs/day
1,1-Dichloroethylene	0.06 ug/l	0.00 lbs/day	3.2 ug/l	0.05 lbs/day
1,2-trans-Dichloroethylene	700.00 ug/l	11.67 lbs/day	0.0 ug/l	0.00 lbs/day
2,4-Dichlorophenol	93.00 ug/l	1.55 lbs/day	790.0 ug/l	13.17 lbs/day
1,2-Dichloropropane	0.52 ug/l	0.01 lbs/day	39.0 ug/l	0.65 lbs/day
1,3-Dichloropropylene	10.00 ug/l	0.17 lbs/day	1700.0 ug/l	28.35 lbs/day
2,4-Dimethylphenol	540.00 ug/l	9.01 lbs/day	2300.0 ug/l	38.36 lbs/day
2,4-Dinitrotoluene	0.11 ug/l	0.00 lbs/day	9.1 ug/l	0.15 lbs/day
2,6-Dinitrotoluene	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
1,2-Diphenylhydrazine	0.04 ug/l	0.00 lbs/day	0.5 ug/l	0.01 lbs/day
Ethylbenzene	3100.00 ug/l	51.70 lbs/day	29000.0 ug/l	483.64 lbs/day
Fluoranthene	300.00 ug/l	5.00 lbs/day	370.0 ug/l	6.17 lbs/day
4-Chlorophenyl phenyl ether				
4-Bromophenyl phenyl ether				
Bis(2-chloroisopropyl) e	1400.00 ug/l	23.35 lbs/day	170000.0 ug/l	2835.12 lbs/day
Bis(2-chloroethoxy) met	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Methylene chloride (HM)	4.70 ug/l	0.08 lbs/day	1600.0 ug/l	26.68 lbs/day
Methyl chloride (HM)	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Methyl bromide (HM)	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Bromoform (HM)	4.30 ug/l	0.07 lbs/day	360.0 ug/l	6.00 lbs/day
Dichlorobromomethane	0.27 ug/l	0.00 lbs/day	22.0 ug/l	0.37 lbs/day
Chlorodibromomethane	0.41 ug/l	0.01 lbs/day	34.0 ug/l	0.57 lbs/day
Hexachlorobutadiene(c)	0.44 ug/l	0.01 lbs/day	50.0 ug/l	0.83 lbs/day
Hexachlorocyclopentadi	240.00 ug/l	4.00 lbs/day	17000.0 ug/l	283.51 lbs/day
Isophorone	8.40 ug/l	0.14 lbs/day	600.0 ug/l	10.01 lbs/day
Naphthalene				
Nitrobenzene	17.00 ug/l	0.28 lbs/day	1900.0 ug/l	31.69 lbs/day
2-Nitrophenol	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
4-Nitrophenol	0.00 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
2,4-Dinitrophenol	70.00 ug/l	1.17 lbs/day	14000.0 ug/l	233.48 lbs/day
4,6-Dinitro-o-cresol	13.00 ug/l	0.22 lbs/day	765.0 ug/l	12.76 lbs/day
N-Nitrosodimethylamine	0.00069 ug/l	0.00 lbs/day	8.1 ug/l	0.14 lbs/day
N-Nitrosodiphenylamine	5.00 ug/l	0.08 lbs/day	16.0 ug/l	0.27 lbs/day
N-Nitrosodi-n-propylami	0.01 ug/l	0.00 lbs/day	1.4 ug/l	0.02 lbs/day
Pentachlorophenol	0.28 ug/l	0.00 lbs/day	8.2 ug/l	0.14 lbs/day

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Phenol	2.10E+04 ug/l	3.50E+02 lbs/day	4.6E+06 ug/l	7.67E+04 lbs/day
Bis(2-ethylhexyl)phthala	1.80 ug/l	0.03 lbs/day	5.9 ug/l	0.10 lbs/day
Butyl benzyl phthalate	3000.00 ug/l	50.03 lbs/day	5200.0 ug/l	86.72 lbs/day
Di-n-butyl phthalate	2700.00 ug/l	45.03 lbs/day	12000.0 ug/l	200.13 lbs/day
Di-n-octyl phthlate				
Diethyl phthalate	23000.00 ug/l	383.58 lbs/day	120000.0 ug/l	2001.26 lbs/day
Dimethyl phthlate	3.13E+05 ug/l	5.22E+03 lbs/day	2.9E+06 ug/l	4.84E+04 lbs/day
Benzo(a)anthracene (P/	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Benzo(a)pyrene (PAH)	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Benzo(b)fluoranthene (F	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Benzo(k)fluoranthene (F	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Chrysene (PAH)	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Acenaphthylene (PAH)				
Anthracene (PAH)	9600.00 ug/l	160.10 lbs/day	0.0 ug/l	0.00 lbs/day
Dibenzo(a,h)anthracene	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Indeno(1,2,3-cd)pyrene	0.0028 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Pyrene (PAH)	960.00 ug/l	16.01 lbs/day	11000.0 ug/l	183.45 lbs/day
Tetrachloroethylene	0.80 ug/l	0.01 lbs/day	8.9 ug/l	0.15 lbs/day
Toluene	6800.00 ug/l	113.40 lbs/day	200000 ug/l	3335.44 lbs/day
Trichloroethylene	2.70 ug/l	0.05 lbs/day	81.0 ug/l	1.35 lbs/day
Vinyl chloride	2.00 ug/l	0.03 lbs/day	525.0 ug/l	8.76 lbs/day
			0.0	0.00 lbs/day
			0.0	0.00 lbs/day
Pesticides				
Aldrin	0.0001 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Dieldrin	0.0001 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Chlordane	0.0006 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
4,4'-DDT	0.0006 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
4,4'-DDE	0.0006 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
4,4'-DDD	0.0008 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
alpha-Endosulfan	0.9300 ug/l	0.02 lbs/day	2.0 ug/l	0.03 lbs/day
beta-Endosulfan	0.9300 ug/l	0.02 lbs/day	2.0 ug/l	0.03 lbs/day
Endosulfan sulfate	0.9300 ug/l	0.02 lbs/day	2.0 ug/l	0.03 lbs/day
Endrin	0.7600 ug/l	0.01 lbs/day	0.8 ug/l	0.01 lbs/day
Endrin aldehyde	0.7600 ug/l	0.01 lbs/day	0.8 ug/l	0.01 lbs/day
Heptachlor	0.0002 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Heptachlor epoxide				
PCB's				
PCB 1242 (Arochlor 124	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1254 (Arochlor 124	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1221 (Arochlor 122	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1232 (Arochlor 123	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1248 (Arochlor 124	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1260 (Arochlor 126	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
PCB-1016 (Arochlor 101	0.000044 ug/l	0.00 lbs/day	0.0 ug/l	0.00 lbs/day
Pesticide				
Toxaphene	0.000750 ug/l	0.00	0.0 ug/l	0.00 lbs/day
Dioxin				
Dioxin (2,3,7,8-TCDD)	1.30E-08 ug/l	0.00 lbs/day	1.40E-08	0.00

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Metals

Antimony	14.0 ug/l	0.23 lbs/day		
Arsenic	50.0 ug/l	0.83 lbs/day	4300.00 ug/l	71.71 lbs/day
Asbestos	7.00E+06 ug/l	1.17E+05 lbs/day		
Beryllium				
Cadmium				
Chromium (III)				
Chromium (VI)				
Copper				
Cyanide	1.30E+03 ug/l	21.68 lbs/day	2.2E+05 ug/l	3668.98 lbs/day
Lead	700.0 ug/l	11.67 lbs/day		
Mercury			0.15 ug/l	0.00 lbs/day
Nickel			4600.00 ug/l	76.72 lbs/day
Selenium	0.1 ug/l	0.00 lbs/day		
Silver	610.0 ug/l	10.17 lbs/day		
Thallium			6.30 ug/l	0.11 lbs/day
Zinc				

There are additional standards that apply to this receiving water, but were not considered in this modeling/waste load allocation analysis.

VII. Mathematical Modeling of Stream Quality

Model configuration was accomplished utilizing standard modeling procedures. Data points were plotted and coefficients adjusted as required to match observed data as closely as possible.

The modeling approach used in this analysis included one or a combination of the following models.

- (1) The Utah River Model, Utah Division of Water Quality, 1992. Based upon STREAMDO IV (Region VIII) and Supplemental Ammonia Toxicity Models; EPA Region VIII, Sept. 1990 and QUAL2E (EPA, Athens, GA).
- (2) Utah Ammonia/Chlorine Model, Utah Division of Water Quality, 1992.
- (3) AMMTOX Model, University of Colorado, Center of Limnology, and EPA Region 8
- (4) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al. Harper Collins Publisher, Inc. 1987, pp. 644.

Coefficients used in the model were based, in part, upon the following references:

- (1) Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens Georgia. EPA/600/3-85/040 June 1985.

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(2) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al.
Harper Collins Publisher, Inc. 1987, pp. 644.

VIII. Modeling Information

The required information for the model may include the following information for both the upstream conditions at low flow and the effluent conditions:

Flow, Q, (cfs or MGD)	D.O. mg/l
Temperature, Deg. C.	Total Residual Chlorine (TRC), mg/l
pH	Total NH3-N, mg/l
BOD5, mg/l	Total Dissolved Solids (TDS), mg/l
Metals, ug/l	Toxic Organics of Concern, ug/l

Other Conditions

In addition to the upstream and effluent conditions, the models require a variety of physical and biological coefficients and other technical information. In the process of actually establishing the permit limits for an effluent, values are used based upon the available data, model calibration, literature values, site visits and best professional judgement.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis. Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Current Upstream Information

	Stream		pH	T-NH3 mg/l as N	BOD5 mg/l	DO mg/l	TRC mg/l	TDS mg/l
	Flow cfs	Temp. Deg. C						
Summer (Irrig. Season)	0.0	17.0	8.2	0.00	0.10	10.15	0.00	400.0
Fall	0.0	15.0	8.1	0.00	0.10	---	0.00	400.0
Winter	0.0	2.4	8.2	0.00	0.10	---	0.00	400.0
Spring	0.0	13.6	8.2	0.00	0.10	---	0.00	400.0
Dissolved Metals	Al ug/l	As ug/l	Cd ug/l	CrIII ug/l	CrVI ug/l	Copper ug/l	Fe ug/l	Pb ug/l
All Seasons	1.59*	0.53*	0.053*	0.53*	2.65*	0.53*	0.83*	0.53*
Dissolved Metals	Hg ug/l	Ni ug/l	Se ug/l	Ag ug/l	Zn ug/l	Boron ug/l		
All Seasons	0.0000	0.53*	1.06*	0.1*	0.053*	10.0		

* 1/2 MDL

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Projected Discharge Information

Season	Flow, MGD	Temp.	TDS mg/l	TDS tons/day
Summer	2.00000	17.0	1100.00	9.17216
Fall	2.00000	15.0		
Winter	2.00000	12.0		
Spring	2.00000	15.0		

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

IX. Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort coincide with the environmental conditions expected at low stream flows.

Effluent Limitation for Flow based upon Water Quality Standards

In-stream criteria of downstream segments will be met with an effluent flow maximum value as follows:

Season	Daily Average	
Summer	2.000 MGD	3.094 cfs
Fall	2.000 MGD	3.094 cfs
Winter	2.000 MGD	3.094 cfs
Spring	2.000 MGD	3.094 cfs

Flow Requirement or Loading Requirement

The calculations in this wasteload analysis utilize the maximum effluent discharge flow of 2 MGD. If the discharger is allowed to have a flow greater than 2 MGD during 7Q10 conditions, and effluent limit concentrations as indicated, then water quality standards will be violated. In order to prevent this from occurring, the permit writers must include the discharge flow limitation as indicated above; or, include loading effluent limits in the permit.

Effluent Limitation for Whole Effluent Toxicity (WET) based upon WET Policy

Effluent Toxicity will not occur in downstream segments if the values below are met.

WET Requirements	LC50 >	EOP Effluent	[Acute]
	IC25 >	100.0% Effluent	[Chronic]

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Effluent Limitation for Biological Oxygen Demand (BOD) based upon Water Quality Standards or Regulations

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD limitation as follows:

Season	Concentration	
Summer	25.0 mg/l as BOD5	416.9 lbs/day
Fall	25.0 mg/l as BOD5	416.9 lbs/day
Winter	25.0 mg/l as BOD5	416.9 lbs/day
Spring	25.0 mg/l as BOD5	416.9 lbs/day

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent D.O. limitation as follows:

Season	Concentration
Summer	5.00
Fall	5.00
Winter	5.00
Spring	5.00

Effluent Limitation for Total Ammonia based upon Water Quality Standards

In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

Season		Concentration	Load	
Summer	4 Day Avg. - Chronic	3.4 mg/l as N	57.4	lbs/day
	1 Hour Avg. - Acute	14.6 mg/l as N	243.8	lbs/day
Fall	4 Day Avg. - Chronic	3.9 mg/l as N	64.6	lbs/day
	1 Hour Avg. - Acute	13.6 mg/l as N	226.9	lbs/day
Winter	4 Day Avg. - Chronic	3.8 mg/l as N	63.1	lbs/day
	1 Hour Avg. - Acute	12.9 mg/l as N	215.0	lbs/day
Spring	4 Day Avg. - Chronic	3.9 mg/l as N	0.0	lbs/day
	1 Hour Avg. - Acute	13.6 mg/l as N	0.0	lbs/day

Acute limit calculated with an Acute Zone of Initial Dilution (ZID) to be equal to 100.%.

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Effluent Limitation for Total Residual Chlorine based upon Water Quality Standards

In-stream criteria of downstream segments for Total Residual Chlorine will be met with an effluent limitation as follows:

Season		Concentration		Load	
Summer	4 Day Avg. - Chronic	0.011	mg/l	0.18	lbs/day
	1 Hour Avg. - Acute	0.019	mg/l	0.32	lbs/day
Fall	4 Day Avg. - Chronic	0.011	mg/l	0.18	lbs/day
	1 Hour Avg. - Acute	0.019	mg/l	0.32	lbs/day
Winter	4 Day Avg. - Chronic	0.011	mg/l	0.18	lbs/day
	1 Hour Avg. - Acute	0.019	mg/l	0.32	lbs/day
Spring	4 Day Avg. - Chronic	0.011	mg/l	0.00	lbs/day
	1 Hour Avg. - Acute	0.019	mg/l	0.00	lbs/day

Effluent Limitations for Total Dissolved Solids based upon Water Quality Standards

Season		Concentration		Load	
Summer	Maximum, Acute	3000.1	mg/l	25.02	tons/day
Fall	Maximum, Acute	3000.1	mg/l	25.02	tons/day
Winter	Maximum, Acute	3000.1	mg/l	25.02	tons/day
Spring	4 Day Avg. - Chronic	3000.1	mg/l	25.02	tons/day

Colorado Salinity Forum Limits Determined by Permitting Section

Effluent Limitations for Total Recoverable Metals based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Metals will be met with an effluent limitation as follows (based upon a hardness of 300 mg/l):

	4 Day Average		Load	1 Hour Average		Load
	Concentration			Concentration		
Aluminum	N/A		N/A	750.0	ug/l	1.2 lbs/day
Arsenic	190.01	ug/l	2.0 lbs/day	340.0	ug/l	0.5 lbs/day
Cadmium	0.61	ug/l	0.0 lbs/day	6.5	ug/l	0.0 lbs/day
Chromium III	211.92	ug/l	2.3 lbs/day	4,433.9	ug/l	7.2 lbs/day
Chromium VI	11.00	ug/l	0.1 lbs/day	16.0	ug/l	0.0 lbs/day
Copper	23.85	ug/l	0.3 lbs/day	39.4	ug/l	0.1 lbs/day
Iron	N/A		N/A	1,000.0	ug/l	1.6 lbs/day
Lead	12.88	ug/l	0.1 lbs/day	330.6	ug/l	0.5 lbs/day
Mercury	0.01	ug/l	0.0 lbs/day	2.4	ug/l	0.0 lbs/day
Nickel	132.14	ug/l	1.4 lbs/day	1,188.5	ug/l	1.9 lbs/day
Selenium	4.60	ug/l	0.0 lbs/day	20.0	ug/l	0.0 lbs/day
Silver	N/A	ug/l	N/A lbs/day	25.0	ug/l	0.0 lbs/day

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Zinc	303.94 ug/l	3.3 lbs/day	303.9	ug/l	0.5 lbs/day
Cyanide	5.20 ug/l	0.1 lbs/day	22.0	ug/l	0.0 lbs/day

**Effluent Limitations for Heat/Temperature based upon
Water Quality Standards**

Summer	19.0 Deg. C.	66.2 Deg. F
Fall	17.0 Deg. C.	62.6 Deg. F
Winter	4.4 Deg. C.	39.9 Deg. F
Spring	15.6 Deg. C.	60.1 Deg. F

**Effluent Limitations for Organics [Pesticides]
Based upon Water Quality Standards**

In-stream criteria of downstream segments for Organics [Pesticides]
will be met with an effluent limit as follows:

	4 Day Average		1 Hour Average		
	Concentration	Load	Concentration	Load	
Aldrin			1.5E+00	ug/l	3.75E-03 lbs/day
Chlordane	4.30E-03 ug/l	7.17E-02 lbs/day	1.2E+00	ug/l	3.00E-03 lbs/day
DDT, DDE	1.00E-03 ug/l	1.67E-02 lbs/day	5.5E-01	ug/l	1.38E-03 lbs/day
Dieldrin	1.90E-03 ug/l	3.17E-02 lbs/day	1.3E+00	ug/l	3.13E-03 lbs/day
Endosulfan	5.60E-02 ug/l	9.34E-01 lbs/day	1.1E-01	ug/l	2.75E-04 lbs/day
Endrin	2.30E-03 ug/l	3.84E-02 lbs/day	9.0E-02	ug/l	2.25E-04 lbs/day
Guthion	0.00E+00 ug/l	0.00E+00 lbs/day	1.0E-02	ug/l	2.50E-05 lbs/day
Heptachlor	3.80E-03 ug/l	6.34E-02 lbs/day	2.6E-01	ug/l	6.50E-04 lbs/day
Lindane	8.00E-02 ug/l	1.33E+00 lbs/day	1.0E+00	ug/l	2.50E-03 lbs/day
Methoxychlor	0.00E+00 ug/l	0.00E+00 lbs/day	3.0E-02	ug/l	7.50E-05 lbs/day
Mirex	0.00E+00 ug/l	0.00E+00 lbs/day	1.0E-02	ug/l	2.50E-05 lbs/day
Parathion	0.00E+00 ug/l	0.00E+00 lbs/day	4.0E-02	ug/l	1.00E-04 lbs/day
PCB's	1.40E-02 ug/l	2.33E-01 lbs/day	2.0E+00	ug/l	5.00E-03 lbs/day
Pentachlorophenol	1.30E+01 ug/l	2.17E+02 lbs/day	2.0E+01	ug/l	5.00E-02 lbs/day
Toxephene	2.00E-04 ug/l	3.34E-03 lbs/day	7.3E-01	ug/l	1.83E-03 lbs/day

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**Effluent Targets for Pollution Indicators
Based upon Water Quality Standards**

In-stream criteria of downstream segments for Pollution Indicators will be met with an effluent limit as follows:

	1 Hour Average	
	Concentration	Loading
Gross Beta (pCi/l)	50.0 pCi/L	
BOD (mg/l)	5.0 mg/l	8.1 lbs/day
Nitrates as N	4.0 mg/l	6.5 lbs/day
Total Phosphorus as P	0.05 mg/l	0.1 lbs/day
Total Suspended Solids	90.0 mg/l	145.5 lbs/day

Note: Pollution indicator targets are for information purposes only.

**Effluent Limitations for Protection of Human Health [Toxics Rule]
Based upon Water Quality Standards (Most stringent of 1C or 3A & 3B as appropriate.)**

In-stream criteria of downstream segments for Protection of Human Health [Toxics] will be met with an effluent limit as follows:

	Maximum Concentration	
	Concentration	Load
Toxic Organics		
Acenaphthene	1.20E+03 ug/l	2.00E+01 lbs/day
Acrolein	3.20E+02 ug/l	5.34E+00 lbs/day
Acrylonitrile	5.90E-02 ug/l	9.84E-04 lbs/day
Benzene	1.20E+00 ug/l	2.00E-02 lbs/day
Benzidine	ug/l	lbs/day
Carbon tetrachloride	2.50E-01 ug/l	4.17E-03 lbs/day
Chlorobenzene	6.80E+02 ug/l	1.13E+01 lbs/day
1,2,4-Trichlorobenzene		
Hexachlorobenzene	7.50E-04 ug/l	1.25E-05 lbs/day
1,2-Dichloroethane	3.80E-01 ug/l	6.34E-03 lbs/day
1,1,1-Trichloroethane		
Hexachloroethane	1.90E+00 ug/l	3.17E-02 lbs/day
1,1-Dichloroethane		
1,1,2-Trichloroethane	6.10E-01 ug/l	1.02E-02 lbs/day
1,1,2,2-Tetrachloroethane	1.70E-01 ug/l	2.84E-03 lbs/day
Chloroethane		
Bis(2-chloroethyl) ether	3.10E-02 ug/l	5.17E-04 lbs/day
2-Chloroethyl vinyl ether		
2-Chloronaphthalene	1.70E+03 ug/l	2.84E+01 lbs/day
2,4,6-Trichlorophenol	2.10E+00 ug/l	3.50E-02 lbs/day
p-Chloro-m-cresol		
Chloroform (HM)	5.70E+00 ug/l	9.51E-02 lbs/day
2-Chlorophenol	1.20E+02 ug/l	2.00E+00 lbs/day
1,2-Dichlorobenzene	2.70E+03 ug/l	4.50E+01 lbs/day
1,3-Dichlorobenzene	4.00E+02 ug/l	6.67E+00 lbs/day

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1,4-Dichlorobenzene	4.00E+02 ug/l	6.67E+00 lbs/day
3,3'-Dichlorobenzidine	4.00E-02 ug/l	6.67E-04 lbs/day
1,1-Dichloroethylene	5.70E-02 ug/l	9.51E-04 lbs/day
1,2-trans-Dichloroethylene1		
2,4-Dichlorophenol	9.30E+01 ug/l	1.55E+00 lbs/day
1,2-Dichloropropane	5.20E-01 ug/l	8.67E-03 lbs/day
1,3-Dichloropropylene	1.00E+01 ug/l	1.67E-01 lbs/day
2,4-Dimethylphenol	5.40E+02 ug/l	9.01E+00 lbs/day
2,4-Dinitrotoluene	1.10E-01 ug/l	1.83E-03 lbs/day
2,6-Dinitrotoluene		
1,2-Diphenylhydrazine	4.00E-02 ug/l	6.67E-04 lbs/day
Ethylbenzene	3.10E+03 ug/l	5.17E+01 lbs/day
Fluoranthene	3.00E+02 ug/l	5.00E+00 lbs/day
4-Chlorophenyl phenyl ether		
4-Bromophenyl phenyl ether		
Bis(2-chloroisopropyl) ether	1.40E+03 ug/l	2.33E+01 lbs/day
Bis(2-chloroethoxy) methane		
Methylene chloride (HM)	4.70E+00 ug/l	7.84E-02 lbs/day
Methyl chloride (HM)		
Methyl bromide (HM)		
Bromoform (HM)	4.30E+00 ug/l	7.17E-02 lbs/day
Dichlorobromomethane(HM)	2.70E-01 ug/l	4.50E-03 lbs/day
Chlorodibromomethane (HM)	4.10E-01 ug/l	6.84E-03 lbs/day
Hexachlorocyclopentadiene	2.40E+02 ug/l	4.00E+00 lbs/day
Isophorone	8.40E+00 ug/l	1.40E-01 lbs/day
Naphthalene		
Nitrobenzene	1.70E+01 ug/l	2.84E-01 lbs/day
2-Nitrophenol		
4-Nitrophenol		
2,4-Dinitrophenol	7.00E+01 ug/l	1.17E+00 lbs/day
4,6-Dinitro-o-cresol	1.30E+01 ug/l	2.17E-01 lbs/day
N-Nitrosodimethylamine	6.90E-04 ug/l	1.15E-05 lbs/day
N-Nitrosodiphenylamine	5.00E+00 ug/l	8.34E-02 lbs/day
N-Nitrosodi-n-propylamine	5.00E-03 ug/l	8.34E-05 lbs/day
Pentachlorophenol	2.80E-01 ug/l	4.67E-03 lbs/day
Phenol	2.10E+04 ug/l	3.50E+02 lbs/day
Bis(2-ethylhexyl)phthalate	1.80E+00 ug/l	3.00E-02 lbs/day
Butyl benzyl phthalate	3.00E+03 ug/l	5.00E+01 lbs/day
Di-n-butyl phthalate	2.70E+03 ug/l	4.50E+01 lbs/day
Di-n-octyl phthlate		
Diethyl phthalate	2.30E+04 ug/l	3.84E+02 lbs/day
Dimethyl phthlate	3.13E+05 ug/l	5.22E+03 lbs/day
Benzo(a)anthracene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Benzo(a)pyrene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Benzo(b)fluoranthene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Benzo(k)fluoranthene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Chrysene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Acenaphthylene (PAH)		
Anthracene (PAH)		
Dibenzo(a,h)anthracene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day
Indeno(1,2,3-cd)pyrene (PAH)	2.80E-03 ug/l	4.67E-05 lbs/day

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Pyrene (PAH)	9.60E+02 ug/l	1.60E+01 lbs/day
Tetrachloroethylene	8.00E-01 ug/l	1.33E-02 lbs/day
Toluene	6.80E+03 ug/l	1.13E+02 lbs/day
Trichloroethylene	2.70E+00 ug/l	4.50E-02 lbs/day
Vinyl chloride	2.00E+00 ug/l	3.34E-02 lbs/day

Pesticides

Aldrin	1.30E-04 ug/l	2.17E-06 lbs/day
Dieldrin	1.40E-04 ug/l	2.33E-06 lbs/day
Chlordane	5.70E-04 ug/l	9.51E-06 lbs/day
4,4'-DDT	5.90E-04 ug/l	9.84E-06 lbs/day
4,4'-DDE	5.90E-04 ug/l	9.84E-06 lbs/day
4,4'-DDD	8.30E-04 ug/l	1.38E-05 lbs/day
alpha-Endosulfan	9.30E-01 ug/l	1.55E-02 lbs/day
beta-Endosulfan	9.30E-01 ug/l	1.55E-02 lbs/day
Endosulfan sulfate	9.30E-01 ug/l	1.55E-02 lbs/day
Endrin	7.60E-01 ug/l	1.27E-02 lbs/day
Endrin aldehyde	7.60E-01 ug/l	1.27E-02 lbs/day
Heptachlor	2.10E-04 ug/l	3.50E-06 lbs/day
Heptachlor epoxide		

PCB's

PCB 1242 (Arochlor 1242)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1254 (Arochlor 1254)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1221 (Arochlor 1221)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1232 (Arochlor 1232)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1248 (Arochlor 1248)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1260 (Arochlor 1260)	4.40E-05 ug/l	7.34E-07 lbs/day
PCB-1016 (Arochlor 1016)	4.40E-05 ug/l	7.34E-07 lbs/day

Pesticide

Toxaphene	7.30E-04 ug/l	1.22E-05 lbs/day
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Metals

Antimony	14.00 ug/l	0.23 lbs/day
Arsenic	50.00 ug/l	0.83 lbs/day
Asbestos	7.00E+06 ug/l	1.17E+05 lbs/day
Beryllium		
Cadmium		
Chromium (III)		
Chromium (VI)		
Copper	1300.04 ug/l	21.68 lbs/day
Cyanide	700.02 ug/l	11.67 lbs/day
Lead	0.00	0.00
Mercury	0.14 ug/l	0.00 lbs/day
Nickel	610.02 ug/l	10.17 lbs/day
Selenium	0.00	0.00
Silver	0.00	0.00
Thallium	1.70 ug/l	0.03 lbs/day
Zinc		

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Dioxin
Dioxin (2,3,7,8-TCDD) 1.30E-08 ug/l 2.17E-10 lbs/day

**Metals Effluent Limitations for Protection of All Beneficial Uses
Based upon Water Quality Standards and Toxics Rule**

	Class 4 Acute Agricultural ug/l	Class 3 Acute Aquatic Wildlife ug/l	Acute Toxics Drinking Water Source ug/l	Acute Toxics Wildlife ug/l	1C Acute Health Criteria ug/l	Acute Most Stringent ug/l	Class 3 Chronic Aquatic Wildlife ug/l
Aluminum		750.0				750.0	N/A
Antimony			14.0	4300.1		14.0	
Arsenic	100.0	340.0	50.0		0.0	50.0	190.0
Barium					1000.0	1000.0	
Beryllium						0.0	
Cadmium	10.0	6.5			0.0	6.5	0.6
Chromium (III)		4433.9			0.0	4433.9	211.9
Chromium (VI)	100.0	16.0			0.0	16.00	11.00
Copper	200.0	39.4	1300.0			39.4	23.9
Cyanide		22.0	220007.1			22.0	5.2
Iron		1000.0				1000.0	
Lead	100.0	330.6			0.0	100.0	12.9
Mercury		2.40	0.1	0.15	0.0	0.14	0.012
Nickel		1188.5	610.0	4600.1		610.0	132.1
Selenium	50.0	20.0			0.0	20.0	4.6
Silver		25.0			0.0	25.0	
Thallium			1.7	6.3		1.7	
Zinc		303.9				303.9	303.9
Boron	750.0					750.0	

Summary Effluent Limitations for Metals [Wasteload Allocation, TMDL]

[If Acute is more stringent than Chronic, then the Chronic takes on the Acute value.]

	WLA Acute ug/l	WLA Chronic ug/l	
Aluminum	750.0	N/A	
Antimony	14.00		
Arsenic	50.0	190.0	Acute Controls
Asbestos	7.00E+06		
Barium			
Beryllium			
Cadmium	6.5	0.6	
Chromium (III)	4433.9	212	
Chromium (VI)	16.0	11.0	
Copper	39.4	23.9	

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Cyanide	22.0	5.2
Iron	1000.0	
Lead	100.0	12.9
Mercury	0.140	0.012
Nickel	610.0	132
Selenium	20.0	4.6
Silver	25.0	N/A
Thallium	1.7	
Zinc	303.9	303.9
Boron	750.02	

Other Effluent Limitations are based upon R317-1.

E. coli 126.0 organisms per 100 ml

X. Antidegradation Considerations

The Utah Antidegradation Policy allows for degradation of existing quality where it is determined that such lowering of water quality is necessary to accommodate important economic or social development in the area in which the waters are protected [R317-2-3]. It has been determined that certain chemical parameters introduced by this discharge will cause an increase of the concentration of said parameters in the receiving waters. Under no conditions will the increase in concentration be allowed to interfere with existing instream water uses.

The antidegradation rules and procedures allow for modification of effluent limits less than those based strictly upon mass balance equations utilizing 100% of the assimilative capacity of the receiving water. Additional factors include considerations for "Blue-ribbon" fisheries, special recreational areas, threatened and endangered species, and drinking water sources.

An Antidegradation Level I Review was conducted on this discharge and its effect on the receiving water. Based upon that review, it has been determined that an Antidegradation Level II Review was not required.

XI. Colorado River Salinity Forum Considerations

Discharges in the Colorado River Basin are required to have their discharge at a TDS loading of less than 1.00 tons/day unless certain exemptions apply. Refer to the Forum's Guidelines for additional information allowing for an exceedence of this value.

XII. Summary Comments

The mathematical modeling and best professional judgement indicate that violations of receiving water beneficial uses with their associated water quality standards, including important downstream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

**Utah Division of Water Quality
Salt Lake City, Utah**

XIII. Notice of UPDES Requirement

This Addendum to the Statement of Basis does not authorize any entity or party to discharge to the waters of the State of Utah. That authority is granted through a UPDES permit issued by the Utah Division of Water Quality. The numbers presented here may be changed as a function of other factors. Dischargers are strongly urged to contact the Permits Section for further information. Permit writers may utilize other information to adjust these limits and/or to determine other limits based upon best available technology and other considerations provided that the values in this wasteload analysis [TMDL] are not compromised. See special provisions in Utah Water Quality Standards for adjustments in the Total Dissolved Solids values based upon background concentration.

Utah Division of Water Quality
801-538-6052
File Name: DugoutCreek_WLA_10-16-2014.xls

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Salt Lake City, Utah**

APPENDIX - Coefficients and Other Model Information

CBOD Coeff. (Kd)20 1/day 2.000	CBOD Coeff. FORCED (Kd)/day 0.000	CBOD Coeff. (Ka)T 1/day 0.799	REAER. Coeff. (Ka)20 (Ka)/day 6445.200	REAER. Coeff. FORCED 1/day 0.000	REAER. Coeff. (Ka)T 1/day 4012.475	NBOD Coeff. (Kn)20 1/day 0.250	NBOD Coeff. (Kn)T 1/day 0.054
Open Coeff. (K4)20 1/day 0.000	Open Coeff. (K4)T 1/day 0.000	NH3 LOSS (K5)20 1/day 4.000	NH3 (K5)T 1/day 1.598	NO2+NO3 LOSS (K6)20 1/day 0.000	NO2+NO3 (K6)T 1/day 0.000	TRC Decay K(CI)20 1/day 32.000	TRC K(CI)(T) 1/day 9.988
BENTHIC DEMAND (SOD)20 gm/m2/day 1.000	BENTHIC DEMAND (SOD)T gm/m2/day 0.284						
K1 CBOD {theta} 1.0	K2 Reaer. {theta} 1.0	K3 NH3 {theta} 1.1	K4 Open {theta} 1.0	K5 NH3 Loss {theta} 1.0	K6 NO2+3 {theta} 1.0	K(CI) TRC {theta} 1.1	S Benthic {theta} 1.1

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Antidegradation Review

An antidegradation review (ADR) was conducted to determine whether the proposed activity complies with the applicable antidegradation requirements for receiving waters that may be affected. The Level I ADR evaluated the criteria of R317-2-3.5(b) and determined that any degradation is de minimis in nature and therefore does not require a Level II review.

Permit No. UT0025593
Minor Industrial

STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH

AUTHORIZATION TO DISCHARGE UNDER THE
UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM
(UPDES)

In compliance with provisions of the *Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated ("UCA") 1953, as amended* (the "Act"),

CANYON FUEL COMPANY, LLC – DUGOUT CANYON MINE

is hereby authorized to discharge from its facility located near Wellington, Utah, with the outfalls located as indicated in this permit, to receiving waters named


Dugout Creek, Pace Creek and an unnamed tributary of Grassy Trail Creek (all tributaries to the Price and Colorado River systems)

in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective September 1, 2015.

This permit and the authorization to discharge shall expire at midnight, August 31, 2020.

Signed this 26 day of August 2015.



Walter L. Baker, P.E.

Director

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Definitions.

1. The "30-day (and monthly) average" is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.
2. The "7-day (and weekly) average" is the arithmetic average of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week which begins on Sunday and ends on Saturday, shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for that calendar week shall be included in the data for the month that contains the Saturday.
3. "Daily Maximum" ("Daily Max.") is the maximum value allowable in any single sample or instantaneous measurement.
4. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.
5. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.
6. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
7. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.
8. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
9. "Director" means Director of the Utah Division of Water Quality.

PART I
Permit No. UT0025593

10. "EPA" means the United States Environmental Protection Agency.
11. "Act" means the "*Utah Water Quality Act*".
12. "Best Management Practices" ("*BMPs*") means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. *BMPs* also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
13. "Coal pile runoff" means the rainfall runoff from or through any coal storage pile.
14. "CWA" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987*.
15. "Illicit discharge" means any discharge to a municipal separate storm sewer that is not composed entirely of storm water except discharges pursuant to a *UPDES* permit (other than the *UPDES* permit for discharges from the municipal separate storm sewer) and discharges from fire fighting activities, fire hydrant flushings, potable water sources including waterline flushings, uncontaminated ground water (including dewatering ground water infiltration), foundation or footing drains where flows are not contaminated with process materials such as solvents, springs, riparian habitats, wetlands, irrigation water, exterior building washdown where there are no chemical or abrasive additives, pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used, and air conditioning condensate.
16. "Landfill" means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile.
17. "Point Source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharges. This term does not include return flows from irrigated agriculture or agriculture storm water runoff.
18. "Runoff coefficient" means the fraction of total rainfall that will appear at a conveyance as runoff.
19. "Section 313 water priority chemical" means a chemical or chemical categories which:

- a. are listed at 40 CFR 372.65 pursuant to Section 313 of Title III of the *Emergency Planning and Community Right-to-Know Act (EPCRA)* (also known as Title III of the *Superfund Amendments and Reauthorization Act (SARA)* of 1986);
 - b. are present at or above threshold levels at a facility subject to *EPCRA*, Section 313 reporting requirements, and
 - c. meet at least one of the following criteria:
 - (1) are listed in Appendix D of 40 CFR 122 on either Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols) or Table IV (certain toxic pollutants and hazardous substances);
 - (2) are listed as a hazardous substance pursuant to Section 311(b)(2)(A) of the *CWA* at 40 CFR 116.4; or
 - (3) are pollutants for which EPA has published acute or chronic toxicity criteria.
20. "Significant materials" includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under Section 101(14) of *CERCLA*; any chemical the facility is required to report pursuant to *EPCRA* Section 313; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges.
21. "Significant spills" includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under Section 311 of the *Clean Water Act* (see 40 CFR 110.10 and 40 CFR 117.21) or Section 102 of *CERCLA* (see 40 CFR 302.4).
22. "Storm water" means storm water runoff, snow melt runoff, and surface runoff and drainage.
23. "Waste pile" means any noncontainerized accumulation of solid, nonflowing waste that is used for treatment or storage.
24. "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable reoccurrence interval of once in 10 years. This information is available in *Weather Bureau Technical Paper No. 40*, May 1961 and *NOAA Atlas 2*, 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

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B. Description of Discharge Points.

The authorization to discharge provided under this permit is limited to those outfalls specifically designated below as discharge locations. A discharge at any location not authorized under a UPDES permit is a violation of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

<u>Outfall Number</u>	<u>Location of Discharge Point(s)</u>
001	Mine water discharge to Dugout Creek. Latitude 39° 41' 01", Longitude 110° 32' 44".
002	Sedimentation pond discharge to Dugout Creek. Latitude 39° 40' 56", Longitude 110° 32' 52".
003	Storage water discharge to Dugout Creek. Latitude 39° 41' 18", Longitude 110° 32' 29".
004	Sedimentation pond (waste rock site) discharge to an unknown tributary of Grassy Trail Creek. Latitude 39° 36' 40", Longitude 110° 36' 43".
005	Pace Canyon fan portal breakout, mine water discharge to Pace Creek. Latitude 39° 40' 17.772", Longitude 110° 30' 29.051".
006	Sediment trap culvert discharge to Pace Creek. Latitude 39° 40' 14.3553", Longitude 110° 30' 32.3161".
007	Sedimentation pond (waste rock site) discharge to an unknown tributary of Grassy Trail Creek. Latitude 39° 36' 42", Longitude 110° 36' 39".

C. Narrative Standard.

It shall be unlawful, and a violation of this permit, for the permittee to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.

D. Specific Limitations and Self-monitoring Requirements.

1. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfalls 001, 002, 003, 004, 005, 006, and 007. Such discharges shall be limited and monitored by the permittee as specified below:

Parameter, Units	Effluent Limitations <u>a/</u>			
	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum
Total Effluent Flow, MGD, <u>b/</u>	2.0			Report
Total Iron, mg/L				1.1
Total Suspended Solids (TSS), mg/L	25	35		70
Total Dissolved Solids (TDS), mg/L, <u>c/</u>	Report			2,400
TDS, tons/day, <u>c/</u>				1.0
pH, Standard Units(SU)			6.5	9.0
Oil & Grease, mg/L, <u>d/</u>				10

mg/L – milligrams per liter; MGD – million gallons per day

Self-Monitoring and Reporting Requirements <u>a/</u>			
Parameter	Frequency	Sample Type	Units
Total Flow, <u>b/</u>	Continuous/ Twice Monthly	Recorder/Measured	MGD
Total Iron	Twice Monthly	Grab	mg/L
TSS	Twice Monthly	Grab	mg/L
TDS, <u>c/</u>	Twice Monthly	Grab	mg/L & tons/day
pH	Twice Monthly	Grab	SU
Oil & Grease, <u>d/</u>	Twice Monthly	Visual, Grab	Yes/No, mg/L

There shall be no visible sheen or floating solids or visible foam in other than trace amounts upon any discharges and there shall be no discharge of any sanitary wastes at any time.

a/ See Definitions, *Part I.A.*, for definition of terms.

b/ the maximum monthly average of 2.0 MGD apply to outfall 001 only. The remaining outfalls shall report the maximum monthly average upon discharging. Flows from outfalls 001 and 005 shall be from a continuous recorder. Flows from the remaining outfalls shall be from either a continuous recorder, or measured at least twice per month upon discharging. If the rate of discharge is controlled, such as from intermittent discharging outfalls, the rate and duration of discharge shall be reported.

c/ The TDS concentration from each of the outfalls shall not exceed 2400 mg/L as a daily maximum limit. No tons per day loading limit will be applied if the concentration of TDS in the discharge is equal to or less than 500 mg/L as a thirty-day average. However, if the 30-day average concentration exceeds 500 mg/L, then the permittee cannot discharge more than 1.0 ton per day as a sum from all discharge points. As previously determined by the Director, the permittee is not able to meet the 500 mg/L

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30-day average or the 1.0 ton per day loading limit. The permittee is required to continue to participate in and/or fund a salinity offset project to include the TDS offset credits as appropriate.

The salinity-offset project shall include TDS credits on a ton-for-ton basis for which the permittee is over the 1.0 ton per day loading limit. The tonnage reduction from the offset project must be calculated by a method similar to one used by the NRCS, Colorado River Basin Salinity Control Forum, or other applicable agency.

If the permittee will be participating in the construction and implementation of a new salinity-offset project, then a project description and implementation schedule shall be submitted to the Director at least six (6) months prior to the implementation date of the project, which will then be reviewed for approval. The salinity offset project description and implementation schedule must be approved by the Director and shall be appended to this permit.

If the permittee will be funding any additional salinity-offset projects through third parties, the permittee shall provide satisfactory evidence to the Director that the required funds have been deposited to the third party within six (6) months of project approval by the Director. A monitoring and adjustment plan to track the TDS credits shall continue to be submitted to the Director for each monthly monitoring period during the life of this permit. Any changes to the monitoring and adjustment plan must be approved by the Director and upon approval shall be appended to this permit.

d/ Oil and grease monitoring shall initially be a visual test. If any oil and/or grease sheens are observed visually, or there is any other reason to believe that oil and/or grease may be present in the discharge, then a grab sample of the effluent must be immediately taken and this sample shall not exceed 10 mg/L.

2. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: at all outfalls prior to mixing with the receiving water.
3. Any overflow, increase in volume of a discharge or discharge from a bypass system caused by precipitation within a 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snow-melt of equivalent volume) at outfalls 002, 004, 006, and 007 may comply with the following limitation instead of the otherwise applicable limitations (for TSS) contained in Part I.D.1:

<u>Effluent Characteristic</u>	<u>Daily Maximum</u>
Settleable Solids	0.5 mL/L

In addition to the monitoring requirements specified under Part I.D.1., all effluent samples collected during storm water discharge events may also be analyzed for settleable solids. Such analyses shall be conducted by grab samples.

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4. The operator shall have the burden of proof that the discharge or increase in discharge was caused by the applicable precipitation event described in Part I.D.3. The alternate limitations in Parts I.D.3 shall not apply to treatment systems that treat underground mine water only.

E. Storm Water Requirements. It has been determined that Dugout Mine has a regulated storm water discharge as per UAC R317-8-3.9., therefore, the following permit conditions governing storm water discharges apply.

1. Coverage of This Section.

- a. Discharges Covered Under This Section. The requirements listed under this section shall apply to storm water discharges from Dugout Mine, subject to effluent limitations listed in Part I.D. of this permit.

- 1) Site Coverage. Storm water discharges from the following portions of Dugout may be eligible for this permit: haul roads (nonpublic roads on which coal or coal refuse is conveyed), access roads (nonpublic roads providing light vehicular traffic within the facility property and to public roadways), railroad spurs, sidings, and internal haulage lines (rail lines used for hauling coal within the facility property and to offsite commercial railroad lines or loading areas), conveyor belts, chutes, and aerial tramway haulage areas (areas under and around coal or refuse conveyor areas, including transfer stations), equipment storage and maintenance yards, coal handling buildings and structures, and inactive coal mines and related areas (abandoned and other inactive mines, refuse disposal sites and other mining-related areas on private lands).

2. Prohibition of Non-storm Water Discharges.

- a. The following non-storm water discharges may be authorized by this permit provided the non-storm water component of the discharge is in compliance with this section; fire fighting activities; fire hydrant flushings; potable water sources including waterline flushings; drinking fountain water; irrigation drainage, lawn watering; routine external building washdown water where detergents or other compounds have not been used in the process; pavement washwaters where spills or leaks of toxic or hazardous materials (including oils and fuels) have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; uncontaminated compressor condensate; uncontaminated springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials such as solvents.

3. Storm Water Pollution Prevention Plan Requirements. Most of the active coal mining-related areas, described in paragraph 1 above, are subject to sediment and erosion control regulations of the U.S. Office of Surface Mining (OSM) that enforces the Surface Mining Control and Reclamation Act (SMCRA). OSM has granted

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authority to the Utah Division of Oil Gas and Mining (DOGM) to implement SMCRA through State SMCRA regulations. All SMCRA requirements regarding control of erosion, siltation and other pollutants resulting from storm water runoff, including road dust resulting from erosion, shall be primary requirements of the pollution prevention plan and shall be included in the contents of the plan directly, or by reference. Where determined to be appropriate for protection of water quality, additional sedimentation and erosion controls may be warranted.

- a. Contents of Plan. The plan shall include at a minimum, the following items:
- 1) Pollution Prevention Team. Each plan shall identify a specific individual or individuals within the facility organization as members of a storm water Pollution Prevention Team that are responsible for developing the storm water pollution prevention plan and assisting the facility manager in its implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.
 - 2) Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources that may reasonably be expected to add significant amounts of pollutants to storm water discharges or that may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials that may potentially be significant pollutant sources. Each plan shall include, at a minimum:
 - a) Deadlines for Plan Preparation and Compliance
Dugout Mine shall prepare and implement a plan in compliance with the provisions of this section within 270 days of the effective date of this permit.
 - b) Keeping Plans Current

Dugout Mine shall amend the plan whenever there is a change in design, construction, operation, or maintenance, that has a significant effect on the potential for the discharge of pollutants to the waters of the State or if the storm water pollution prevention plan proves to be ineffective in eliminating or significantly minimizing pollutants from sources identified by the plan, or in otherwise achieving the general objectives of controlling pollutants in storm water discharges associated with the activities at the mine.

c) Drainage.

- (1) A site map, such as a drainage map required for SMCRA permit applications, that indicates drainage areas and storm water outfalls. These shall include but not be limited to the following:
 - (a) Drainage direction and discharge points from all applicable mining-related areas described in paragraph 1.a (1). (Site Coverage) above, including culvert and sump discharges from roads and rail beds and also from equipment and maintenance areas subject to storm runoff of fuel, lubricants and other potentially harmful liquids.
 - (b) Location of each existing erosion and sedimentation control structure or other control measures for reducing pollutants in storm water runoff.
 - (c) Receiving streams or other surface water bodies.
 - (d) Locations exposed to precipitation that contain acidic spoil, refuse or unreclaimed disturbed areas.
 - (e) Locations where major spills or leaks of toxic or hazardous pollutants have occurred.
 - (f) Locations where liquid storage tanks containing potential pollutants, such as caustics, hydraulic fluids and lubricants, are exposed to precipitation.
 - (g) Locations where fueling stations, vehicle and equipment maintenance areas are exposed to precipitation.
 - (h) Locations of outfalls and the types of discharges contained in the drainage areas of the outfalls.
- (2) For each area of the facility that generates storm water discharges associated with the mining-related

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activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow, and an identification of the types of pollutants that are likely to be present in storm water discharges associated with the activity. Factors to consider include the toxicity of the pollutant; quantity of chemicals used, produced or discharged; the likelihood of contact with storm water; and history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified.

- d) Inventory of Exposed Materials. An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, stored or disposed in a manner to allow exposure to storm water method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives.
- e) Spills and Leaks. A list of significant spills and leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility beginning 3 years prior to the effective date of this permit. Such list shall be updated as appropriate during the term of the permit.
- f) Sampling Data. A summary of any existing discharge sampling data describing pollutants in storm water discharges from the portions of Dugout covered by this permit, including a summary of any sampling data collected during the term of this permit.
- g) Risk Identification and Summary of Potential Pollutant Sources. A narrative description of the potential pollutant sources from the following activities: truck traffic on haul roads and resulting generation of sediment subject to runoff and dust generation; fuel or other liquid storage; pressure lines containing slurry, hydraulic fluid or other potential harmful liquids; and loading or temporary storage of acidic refuse or spoil. Specific potential pollutants shall be identified where known.

- 3) Measures and Controls. Dugout Mine shall develop a description of storm water management controls appropriate for the facility and implement such controls. The appropriateness and priorities of controls in a plan shall reflect identified potential sources of pollutants at Dugout Mine. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls.
- a) Good Housekeeping. Good housekeeping requires the maintenance of areas that may contribute pollutants to storm water discharges in a clean, orderly manner. These are practices that would minimize the generation of pollutants at the source or before it would be necessary to employ sediment ponds or other control measures at the discharge outlets. Where applicable, such measures or other equivalent measures would include the following: sweepers and covered storage to minimize dust generation and storm runoff; conservation of vegetation where possible to minimize erosion; watering of haul roads to minimize dust generation; collection, removal, and proper disposal of waste oils and other fluids resulting from vehicle and equipment maintenance; or other equivalent measures.
 - b) Preventive Maintenance. A preventive maintenance program shall involve timely inspection and maintenance of storm water management devices as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems. Where applicable, such measures would include the following: removal and proper disposal of settled solids in catch basins to allow sufficient retention capacity; periodic replacement of siltation control measures subject to deterioration such as straw bales; inspections of storage tanks and pressure lines for fuels, lubricants, hydraulic fluid or slurry to prevent leaks due to deterioration or faulty connections; or other equivalent measures.
 - c) Spill Prevention and Response Procedures. Areas where potential spills that can contribute pollutants to storm water discharges can occur, and their accompanying drainage points shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures for cleaning up spills shall be identified in the plan and made available to the appropriate

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personnel. The necessary equipment to implement a clean up shall be available to personnel.

- d) Inspections. In addition to or as part of the comprehensive site evaluation required under paragraph 3.a.(4) of this section, qualified facility personnel shall be identified to inspect designated areas of the facility at appropriate intervals specified in the plan. The following shall be included in the plan:
- (1) Active Mining-Related Areas and Those Inactive Areas Under SMCRA Bond Authority. The plan shall require quarterly inspections by the facility personnel for areas of the facility covered by pollution prevention plan requirements. This inspection interval corresponds with the quarterly inspections for the entire facility required to be provided by SMCRA authority inspectors for all mining-related areas under SMCRA authority, including sediment and erosion control measures. Inspections by the facility representative may be done at the same time as the mandatory inspections performed by SMCRA inspectors. Records of inspections of the SMCRA authority facility representative shall be maintained.
 - (2) Inactive Mining-Related Areas Not Under SMCRA Bond. The plan shall require annual inspections by the facility representative except in situations referred to in paragraph 3.a.(4)(d) below.
 - (3) Inspection Records. The plan shall require that inspection records of the facility representative and those of the SMCRA authority inspector shall be maintained. A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections.
- e) Employee Training. Employee training programs shall inform personnel responsible for implementing activities identified in the storm water pollution prevention plan or otherwise responsible for storm water management at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as spill response, good housekeeping and material management practices. The pollution prevention plan shall identify periodic dates for such training.

- f) Record keeping and Internal Reporting Procedures. A description of incidents (such as spills, or other discharges) along with other information describing the quality and quantity of storm water discharges shall be included in the plan required under this part. Inspections and maintenance activities shall be documented and records of such activities shall be incorporated into the plan.

- g) Non-storm Water Discharges.
 - (1) Certification. The plan shall include a certification that the discharge has been tested or evaluated for the presence of non-storm water discharges such as drainage from underground portions of inactive mines or floor drains from maintenance or coal handling buildings. The certification shall include the identification of potential significant sources of non-storm water discharges at the site, a description of the results of any test and/or evaluation, a description of the evaluation criteria or testing method used, the date of any testing and/or evaluation, and the onsite drainage points that were directly observed during the test. Certifications shall be signed in accordance with Part IV.G.4. of this permit.

 - (2) Exceptions. Except for flows from fire fighting activities, authorized sources of non-storm water listed in Part I.E.2.a. that are combined with storm water discharges associated with industrial activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

 - (3) Failure to Certify. If Dugout Mine is unable to provide the certification required (testing or other evaluation for non-storm water discharges), the Director must be notified within 180 days after the effective date of this permit. If the failure to certify is caused by the inability to perform adequate tests or evaluations, such notification shall describe: the procedure of any test conducted for the presence of non-storm water discharges; the results of such test or other relevant observations; potential sources of non-storm water to the storm discharge lines; and why adequate tests for such storm discharge lines

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were not feasible. Non-storm water discharges to waters of the State that are not authorized by a UPDES permit are unlawful, and must be terminated.

- h) Sediment and Erosion Control. The plan shall identify areas that, due to topography, activities, or other factors, have a high potential for significant soil erosion, and identify structural, vegetative, and/or stabilization measures to be used to limit erosion and reduce sediment concentrations in storm water discharges. As indicated in paragraph I.E.3. above, SMCRA requirements regarding sediment and erosion control measures are primary requirements of the pollution prevention plan for mining-related areas subject to SMCRA authority. The following sediment and erosion control measures or other equivalent measures, should be included in the plan where reasonable and appropriate for all areas subject to storm water runoff:
- (1) Stabilization Measures. Interim and permanent stabilization measures to minimize erosion and lessen amount of structural sediment control measures needed, including: mature vegetation preservation; temporary seeding; permanent seeding and planting; temporary mulching, matting, and netting; sod stabilization; vegetative buffer strips; temporary chemical mulch, soil binders, and soil palliatives; nonacidic road surfacing material; and protective trees.
 - (2) Structural Measures. Structural measures to lessen erosion and reduce sediment discharges, including: silt fences; earth dikes; straw dikes; gradient terraces; drainage swales; sediment traps; pipe slope drains; porous rock check dams; sedimentation ponds; riprap channel protection; capping of contaminated sources; and physical/chemical treatment of storm water.
- i) Management of Flow. The plan shall contain a narrative consideration of the appropriateness of traditional storm water management practices (other than those as sediment and erosion control measures listed above) used to manage storm water runoff in a manner that reduces pollutants in storm water runoff from the site. The plan shall provide that the measures, which the permittee determines to be reasonable and appropriate, shall be implemented and maintained. Appropriate measures may include: discharge

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diversions; drainage/storm water conveyances; runoff dispersion; sediment control and collection; vegetation/soil stabilization; capping of contaminated sources; treatment; or other equivalent measures.

- 4) Comprehensive Site Compliance Evaluation. Qualified personnel shall conduct site compliance evaluations at intervals specified in the plan, but in no case less than once a year. Such evaluations shall provide:
- a) Areas contributing to a storm water discharge associated with coal mining-related areas shall be visually inspected for evidence of, or the potential for, pollutants entering the drainage system. These areas include haul and access roads; railroad spurs, sidings, and internal haulage lines; conveyor belts, chutes and aerial tramways; equipment storage and maintenance yards; coal handling buildings and structures; and inactive mines and related areas. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, sediment and erosion control measures, and other structural pollution prevention measures, as indicated in paragraphs 3.a.(3)(h) and 3.a.(3)(i) above and where identified in the plan, shall be observed to ensure that they are operating correctly. A visual evaluation of any equipment needed to implement the plan, such as spill response equipment, shall be made.
 - b) Based on the results of the evaluation, the description of potential pollutant sources identified in the plan, in accordance with paragraph 3.a.(2) of this section, and pollution prevention measures and controls identified in the plan, in accordance with paragraph 3.a.(3) of this section, shall be revised as appropriate within 2 weeks of such evaluation and shall provide for implementation of any changes to the plan in a timely manner. For inactive mines, such revisions may be extended to a maximum of 12 weeks after the evaluation.
 - c) A report summarizing the scope of the evaluation, personnel making the evaluation, the date(s) of the evaluation, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with paragraph 3.a.(4)(b) above shall be made and retained as part of the storm water pollution prevention plan for at least 3 years after the date of the evaluation. The

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report shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with Part IV.G.4. (Signatory Requirements) of this permit.

- d) Where compliance evaluation schedules overlap with inspections required under 3.a.(3)(d), the compliance evaluation may be conducted in place of one such inspection. Where annual site compliance evaluations are shown in the plan to be impractical for inactive mining sites due to the remote location and inaccessibility of the site, site inspections required under this part shall be conducted at appropriate intervals specified in the plan, but, in no case less than once in 3 years.

4. Numeric Effluent Limitations. There are no additional numeric effluent limitations beyond those described in Part I.E. of this permit.

5. Monitoring and Reporting Requirements.

- a. Benchmark Analytical Monitoring Requirements. Dugout Mine must monitor their storm water discharges associated with industrial activity at least quarterly (4 times per year) during years 2 and 4 of the permit cycle except as provided in paragraphs 5.a.(3) (Sampling Waiver), 5.a.(4) (Representative Discharge), and 5.a.(5) (Alternative Certification). Dugout Mine is required to monitor their storm water discharges for the pollutants of concern listed in Table E. below. Reports must be made in accordance with 5.b. (Reporting). In addition to the parameters listed in Table E. below, Dugout Mine must provide the date and duration (in hours) of the storm event(s) sampled; rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge sampled.

The results of benchmark monitoring are primarily for Dugout Mine's use to determine the overall effectiveness of the SWPPP in controlling the discharge of pollutants to receiving waters. Benchmark values are not viewed as permit limitations. An exceedance of a benchmark value does not, in and of itself, constitute a violation of this permit. While exceedance of a benchmark value does not automatically indicate a violation of a water quality standard has occurred, it does signal that modifications to the SWPPP or more specific pollution prevention controls may be necessary.

Table E.
Monitoring Requirements for Coal Mining Facilities

Pollutants of Concern	Cut-Off Concentration
Total Recoverable Aluminum	0.75 mg/L
Total Recoverable Iron	1.0 mg/L
Total Suspended Solids	100 mg/L

- 1) Monitoring Periods. Dugout Mine shall monitor samples collected during the sampling periods of: January through March, April through June, July through September, and October through December during the second and fourth years of this permit cycle.
- 2) Sample Type. A minimum of one grab sample shall be taken. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. The required 72-hour storm event interval is waived where the preceding measurable storm event did not result in a measurable discharge from the facility. The required 72-hour storm event interval may also be waived where Dugout Mine documents that less than a 72-hour interval is representative for local storm events during the season when sampling is being conducted. The grab sample shall be taken during the first 30 minutes of the discharge. If the collection of a grab sample during the first 30 minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first 30 minutes was impracticable. If storm water discharges associated with industrial activity commingle with process or nonprocess water, then where practicable permittees must attempt to sample the storm water discharge before it mixes with the non-storm water discharge.
- 3) Sampling Waiver.
 - a) Adverse Conditions. If Dugout Mine is unable to collect samples within a specified sampling period due to adverse climatic conditions, thus a substitute sample shall be collected from a separate qualifying event in the next monitoring period and the data submitted along with the data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricanes, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

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- b) Low Concentration Waiver. When the average concentration for a pollutant calculated from all monitoring data collected from an outfall during the second year monitoring is less than the corresponding value for that pollutant listed in Table E. under the column Monitoring Cut-Off Concentration, Dugout Mine may waive monitoring and reporting requirements for the fourth year monitoring period. Dugout Mine must submit to the Director, in lieu of the monitoring data, a certification that there has not been a significant change in industrial activity or the pollution prevention measures in area of the facility that drains to the outfall for which sampling was waived.
 - c) Inactive and Unstaffed Site. If Dugout Mine is unable to conduct quarterly chemical storm water sampling at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirements as long as the facility remains inactive and unstaffed. Dugout Mine must submit to the Director, in lieu of monitoring data, a certification statement on the Storm Water Discharge Monitoring Report (SWDMR) stating that the site is inactive and unstaffed so that collecting a sample during a qualifying event is not possible.
- 4) Representative Discharge. If the facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, discharge substantially identical effluents, Dugout Mine may test the effluent of one of such outfalls and report that the quantitative data also applies to the substantially identical outfall(s) provided that Dugout Mine includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that Dugout Mine believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan. Dugout Mine shall include the description of the location of the outfalls, explanation of why outfalls are expected to discharge substantially identical effluents, and estimate of the size of the drainage area and runoff coefficient with the SWDMR.
- 5) Alternative Certification. Dugout Mine is not subject to the monitoring requirements of this section provided that certification is made for a given outfall or on a pollutant-by-pollutant basis in lieu of monitoring reports required under paragraph b. below, under penalty

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of law, signed in accordance with Part IV.G.4. (Signatory Requirements). The Certification shall state that material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, industrial machinery or operations, or significant materials from past industrial activity that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and are not expected to be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to DWQ in accordance with Part II.D. of this permit. In the case of certifying that a pollutant is not present, Dugout Mine must submit the certification along with the monitoring reports required under paragraph b. below. If Dugout Miner cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.

- b. Reporting. Dugout Mine shall submit monitoring results for each outfall associated with industrial activity [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the second year reporting period, on Storm Water Discharge Monitoring Report (SWDMR) form(s) postmarked no later than the 31st day of the following March. Monitoring results [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the fourth year reporting period shall be submitted on SWDMR form(s) postmarked no later than the 31st day of the following March. For each outfall, one signed SWDMR form must be submitted to the Director per storm event sampled. Signed copies of SWDMRs, or said certifications, shall be submitted to the Director at the address listed in Part II.D. of the permit.
- c. Visual Examination of Storm Water Quality. Dugout shall perform and document a visual examination of a representative storm water discharge at the following frequencies: quarterly for active areas under SMCRA bond located in areas with average annual precipitation over 20 inches; semi-annually for inactive areas under SMCRA bond, and active areas under SMCRA bond located in areas with average annual precipitation of 20 inches or less; visual examinations are not required at inactive areas not under SMCRA bond.
 - 1) Visual Monitoring Periods. Examinations shall be conducted in each of the following periods for the purposes of visually inspecting storm water runoff or snow melt: Quarterly-January through March; April through June; July through September; and October through December. Semi-annually—January through June and July through December.

- 2) Sample and Data Collection. Examinations shall be made of samples collected within the first 60 minutes (or as soon thereafter as practical, but not to exceed two hours) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well-lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual will carry out the collection and examination of discharges for the life of the permit.

- 3) Visual Storm Water Discharge Examination Reports. Visual examination reports must be maintained onsite in the pollution prevention plan. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

- A. Representative Sampling Samples taken in compliance with the monitoring requirements established under *Part I* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Sludge samples shall be collected at a location representative of the quality of sludge immediately prior to the use-disposal practice.
- B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under *Utah Administrative Code ("UAC") R317-2-10*, unless other test procedures have been specified in this permit.
- C. Penalties for Tampering. The *Act* provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both.
- D. Reporting of Monitoring Results. Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), post-marked no later than the 28th day of the month following the completed reporting period. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part IV.G)*, and submitted to the Director, Division of Water Quality at the following address:
- original to: Department of Environmental Quality
 Division of Water Quality
 195 North 1950 West
 PO Box 144870
 Salt Lake City, Utah 84114-4870
- E. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.
- F. Additional Monitoring by the Permittee. If the permittee monitors any parameter more frequently than required by this permit, using test procedures approved under *UAC R317-2-10* or as otherwise specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated. Only those parameters required by the permit need to be reported.
- G. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:

2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location.

I. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall (orally) report any noncompliance which may seriously endanger health or environment as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of circumstances. The report shall be made to the Division of Water Quality, (801) 536-4300, or 24 hour answering service (801) 536-4123.
2. The following occurrences of noncompliance shall be reported by telephone (801) 536-4123 as soon as possible but no later than 24 hours from the time the permittee becomes aware of the circumstances:
 - a. Any noncompliance which may endanger health or the environment;
 - b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See *Part III.G, Bypass of Treatment Facilities.*);
 - c. Any upset which exceeds any effluent limitation in the permit (See *Part III.H, Upset Conditions.*); or,
 - d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit.
3. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times;
 - c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

- d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.
 - e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.
- 4. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Division of Water Quality, (801) 536-4300.
 - 5. Reports shall be submitted to the addresses in *Part II.D, Reporting of Monitoring Results*.
- J. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for *Part II.D* are submitted. The reports shall contain the information listed in *Part II.I.3*.
- K. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:
- 1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;
 - 2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 - 3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,
 - 4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

- A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
- B. Penalties for Violations of Permit Conditions. The *Act* provides that any person who violates a permit condition implementing provisions of the *Act* is subject to a civil penalty not to exceed \$10,000 per day of such violation. Any person who willfully or negligently violates permit conditions of the Act is subject to a fine not exceeding \$25,000 per day of violation; Any person convicted under *UCA 19-5-115(2)* a second time shall be punished by a fine not exceeding \$50,000 per day. Except as provided at *Part III.G, Bypass of Treatment Facilities* and *Part III.H, Upset Conditions*, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.
- C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
- D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.
- E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.
- F. Removed Substances. Collected screening, grit, solids, sludges, or other pollutants removed in the course of treatment shall be buried or disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter backwash shall not directly enter either the final effluent or waters of the state by any other direct route.
- G. Bypass of Treatment Facilities.
 - 1. Bypass Not Exceeding Limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to 2. and 3. of this section.

2. Prohibition of Bypass.

- a. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:
 - (1) Bypass was unavoidable to prevent loss of human life, personal injury, or severe property damage;
 - (2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and
 - (3) The permittee submitted notices as required under section G.3.
- b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in sections G.2a. (1), (2) and (3).

3. Notice.

- a. Anticipated bypass. Except as provided above in section G.2. and below in section G. 3.b, if the permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:
 - (1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages;
 - (2) A specific bypass plan describing the work to be performed including scheduled dates and times. The permittee must notify the Director in advance of any changes to the bypass schedule;
 - (3) Description of specific measures to be taken to minimize environmental and public health impacts;
 - (4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;

- (5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and
 - (6) Any additional information requested by the Director.
- b. Emergency Bypass. Where ninety days advance notice is not possible, the permittee must notify the Director, and the Director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in section G.3.a.(1) through (6i) to the extent practicable.
- c. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass to the Director as required under Part II.I., Twenty Four Hour Reporting. The permittee shall also immediately notify the Director of the Department of Natural Resources, the public and downstream users and shall implement measures to minimize impacts to public health and environment to the extent practicable.

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of paragraph 2. of this section are met. Director's administrative determination regarding a claim of upset cannot be judiciously challenged by the permittee until such time as an action is initiated for noncompliance.
2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - a. An upset occurred and that the permittee can identify the cause(s) of the upset;
 - b. The permitted facility was at the time being properly operated;
 - c. The permittee submitted notice of the upset as required under Part II.I, Twenty-four Hour Notice of Noncompliance Reporting; and,
 - d. The permittee complied with any remedial measures required under Part III.D, Duty to Mitigate.
3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

- I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of *The Water Quality Act of 1987* for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.
- J. Changes in Discharge of Toxic Substances. Notification shall be provided to the Director as soon as the permittee knows of, or has reason to believe:
1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":
 - a. One hundred micrograms per liter (100 ug/L);
 - b. Two hundred micrograms per liter (200 ug/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/L) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
 - c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(7)* or (10); or,
 - d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.
 2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":
 - a. Five hundred micrograms per liter (500 ug/L);
 - b. One milligram per liter (1 mg/L) for antimony;
 - c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(9)*; or,
 - d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.
- K. Industrial Pretreatment. Any wastewaters discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of *The Water Quality Act of 1987*, the permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at *40 CFR 403*, the State Pretreatment Requirements at

Part III
Permit No UT0025593

UAC R317-8-8, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters.

In addition, in accordance with *40 CFR 403.12(p)(1)*, the permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if they discharge any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under *40 CFR 261*. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

IV. GENERAL REQUIREMENTS

- A. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are not subject to effluent limitations in the permit. In addition, if there are any planned substantial changes to the permittee's existing sludge facilities or their manner of operation or to current sludge management practices of storage and disposal, the permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.
- B. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
- C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.
- D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.
- E. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.
- F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.
- G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.
 - 1. All permit applications shall be signed by either a principal executive officer or ranking elected official
 - 2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

PART IV
Permit No. UT0025593

- a. The authorization is made in writing by a person described above and submitted to the Director, and,
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
3. Changes to authorization. If an authorization under paragraph IV.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.
 4. Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
- H. Penalties for Falsification of Reports. The *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than \$10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.
- I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential
- J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the permittee of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the *Act*.
- K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any

invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

- L. Severability. The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.
- M. Transfers. This permit may be automatically transferred to a new permittee if:
1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;
 2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,
 3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.
- N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by *UCA 19-5-117*.
- O. Water Quality-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:
1. Water Quality Standards for the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.
 2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.
 3. A revision to the current Water Quality Management Plan is approved and adopted which calls for different effluent limitations than contained in this permit.
- P. Toxicity Limitation-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include whole effluent toxicity (WET) testing, a WET limitation, a compliance schedule, a compliance date, additional or modified numerical limitations, or any other conditions related to the control of toxicants if toxicity is detected during the life of this permit.



**Canyon Fuel
Company, LLC**

A Subsidiary of Bowls Resource Holdings LLC



Dugout Canyon Mine

P.O. Box 1029
Wellington, Utah 84542
(435) 637-6360
Fax (435) 636-2897

June 1, 2015

Mr. Ken Hoffman
Permits & Compliance Section
Division of Water Quality
Utah Department of Environmental Quality
PO Box 144870
Salt Lake City, UT 84114-4870

Re: ADR Application

Dear Mr. Hoffman:

Please find Dugout's Antidegradation review form from the Utah Division of Water Quality.

If you have any questions or require further information, please contact me at (435) 636-2898.

Sincerely,

William King
Mining Engineer

Attachments

Document Date 6/5/2015



DWQ-2015-006804

NK

ANTIDEGRADATION REVIEW FORM

UTAH DIVISION OF WATER QUALITY

Instructions

The objective of antidegradation rules and policies is to protect existing high quality waters and set forth a process for determining where and how much degradation is allowable for socially and/or economically important reasons. In accordance with Utah Administrative Code (UAC R317-2-3), an antidegradation review (ADR) is a permit requirement for any project that will increase the level of pollutants in waters of the state. The rule outlines requirements for both Level I and Level II ADRs, as well as public comment procedures. This review form is intended to assist the applicant and Division of Water Quality (DWQ) staff in complying with the rule but is not a substitute for the complete rule in R317-2-3.5. Additional details can be found in the *Utah Antidegradation Implementation Guidance* and relevant sections of the guidance are cited in this review form.

ADRs should be among the first steps of an application for a UPDES permit because the review helps establish treatment expectations. The level of effort and amount of information required for the ADR depends on the nature of the project and the characteristics of the receiving water. To avoid unnecessary delays in permit issuance, the Division of Water Quality (DWQ) recommends that the process be initiated at least one year prior to the date a final approved permit is required.

DWQ will determine if the project will impair beneficial uses (Level I ADR) using information provided by the applicant and whether a Level II ADR is required. The applicant is responsible for conducting the Level II ADR. For the permit to be approved, the Level II ADR must document that all feasible measures have been undertaken to minimize pollution for socially, environmentally or economically beneficial projects resulting in an increase in pollution to waters of the state.

For permits requiring a Level II ADR, this antidegradation form must be completed and approved by DWQ before any UPDES permit can be issued. Typically, the ADR form is completed in an iterative manner in consultation with DWQ. The applicant should first complete the statement of social, environmental and economic importance (SEEI) in Part C and determine the parameters of concern (POC) in Part D. Once the POCs are agreed upon by DWQ, the alternatives analysis and selection of preferred alternative in Part E can be conducted based on minimizing degradation resulting from discharge of the POCs. Once the applicant and DWQ agree upon the preferred alternative, the review is considered complete, and the form must be signed, dated, and submitted to DWQ.

For additional clarification on the antidegradation review process and procedures, please contact Nicholas von Stackelberg (801-536-4374) or Jeff Ostermiller (801-536-4370).

Antidegradation Review Form

Part A: Applicant Information

Facility Name: Dugout Canyon Mine

Facility Owner: Canyon Fuel Company, LLC

Facility Location: P.O. Box 1029, Wellinton, Utah, 84542

Form Prepared By: William King, Mining Engineer

Outfall Number: 007

Receiving Water: Unnamed Tributary to Grassy Trail Creek

What Are the Designated Uses of the Receiving Water (R317-2-6)?

Domestic Water Supply: None

Recreation: 2B - Secondary Contact

Aquatic Life: 3C - Nongame Fish

Agricultural Water Supply: 4

Great Salt Lake: None

Category of Receiving Water (R317-2-3.2, -3.3, and -3.4): Category 3

UPDES Permit Number (if applicable): UT0025593

Effluent Flow Reviewed: The sediment pond will be designed for a 100 year 24-hour event. Any discharge would be from an excessive event.

Typically, this should be the maximum daily discharge at the design capacity of the facility. Exceptions should be noted.

What is the application for? (check all that apply)

- ☒ A UPDES permit for a new facility, project, or outfall.
- ☐ A UPDES permit renewal with an expansion or modification of an existing wastewater treatment works.
- ☐ A UPDES permit renewal requiring limits for a pollutant not covered by the previous permit and/or an increase to existing permit limits.
- ☐ A UPDES permit renewal with no changes in facility operations.

Part B. Is a Level II ADR required?

This section of the form is intended to help applicants determine if a Level II ADR is required for specific permitted activities. In addition, the Executive Secretary may require a Level II ADR for an activity with the potential for major impact on the quality of waters of the state (R317-2-3.5a.1).

B1. The receiving water or downstream water is a Class 1C drinking water source.

☐ **Yes** A Level II ADR is required (Proceed to Part C of the Form)

☒ **No** (Proceed to Part B2 of the Form)

B2. The UPDES permit is new or is being renewed and the proposed effluent concentration and loading limits are higher than the concentration and loading limits in the previous permit and any previous antidegradation review(s).

☒ **Yes** (Proceed to Part B3 of the Form)

☐ **No** No Level II ADR is required and there is no need to proceed further with review questions.

B3. Will any pollutants use assimilative capacity of the receiving water, i.e. do the pollutant concentrations in the effluent exceed those in the receiving waters at critical conditions? For most pollutants, effluent concentrations that are higher than the ambient concentrations require an antidegradation review? For a few pollutants such as dissolved oxygen, an antidegradation review is required if the effluent concentrations are less than the ambient concentrations in the receiving water. (Section 3.3.3 of Implementation Guidance)

☒ **Yes** (Proceed to Part B4 of the Form)

☐ **No** No Level II ADR is required and there is no need to proceed further with review questions.

B4. Are water quality impacts of the proposed project temporary and limited (Section 3.3.4 of Implementation Guidance)? Proposed projects that will have temporary and limited effects on water quality can be exempted from a Level II ADR.

☐ **Yes** Identify the reasons used to justify this determination in Part B4.1 and proceed to Part G. No Level II ADR is required.

☒ **No** A Level II ADR is required (Proceed to Part C)

B4.1 Complete this question only if the applicant is requesting a Level II review exclusion for temporary and limited projects (see R317-2-3.5(b)(3) and R317-2-3.5(b)(4)). For projects requesting a temporary and limited exclusion please indicate the factor(s) used to justify this determination (check all that apply and provide details as appropriate) (Section 3.3.4 of Implementation Guidance):

☐ Water quality impacts will be temporary and related exclusively to sediment or turbidity and fish spawning will not be impaired.

Factors to be considered in determining whether water quality impacts will be temporary and limited:

- a) The length of time during which water quality will be lowered:
- b) The percent change in ambient concentrations of pollutants:
- c) Pollutants affected:
- d) Likelihood for long-term water quality benefits:
- e) Potential for any residual long-term influences on existing uses:
- f) Impairment of fish spawning, survival and development of aquatic fauna excluding fish removal efforts:

Additional justification, as needed:

Level II ADR

Part C, D, E, and F of the form constitute the Level II ADR Review. The applicant must provide as much detail as necessary for DWQ to perform the antidegradation review. Questions are provided for the convenience of applicants; however, for more complex permits it may be more effective to provide the required information in a separate report. Applicants that prefer a separate report should record the report name here and proceed to Part G of the form.

Optional Report Name:

Part C. Is the degradation from the project socially and economically necessary to accommodate important social or economic development in the area in which the waters are located? *The applicant must provide as much detail as necessary for DWQ to concur that the project is socially and economically necessary when answering the questions in this section. More information is available in Section 6.2 of the Implementation Guidance.*

C1. Describe the social and economic benefits that would be realized through the proposed project, including the number and nature of jobs created and anticipated tax revenues.

The social and economic benefits realized through Dugout's Waste Rock Expansion are extensive. This Waste Rock Site receives waste refuse from Canyon Fuel Company's Castle Valley Preparation Plant. The Castle Valley Preparation Plant washes coal from all three Canyon Fuel Mines. In today's market coal quality is becoming increasingly important and essential to Canyon Fuel's success. Therefore the expansion of Dugout's Waste Rock Site directly effects all Canyon Fuel Mines at about 800 jobs.

C2. Describe any environmental benefits to be realized through implementation of the proposed project.

C3. Describe any social and economic losses that may result from the project, including impacts to recreation or commercial development.

We are unaware of any social or economic losses due to Dugout's Waste Rock Site Expansion.

C4. Summarize any supporting information from the affected communities on preserving assimilative capacity to support future growth and development.

Canyon Fuel Company's current workforce has and will continue to have a positive overall impact on affected communities. With the coal mining industry slowing down and shutting doors it has negatively affected many communities.

Canyon Fuel Company has remained strong and increased capacity providing the jobs necessary to support the affected communities. Overall, impacts to existing infrastructure from added employees will be neutral since our workforce expansion is primarily from existing residents. Without the jobs provided by Canyon Fuel Company, the unemployment rate would be worse than it is currently, adding to the strain of the state and local resources.

C5. Please describe any structures or equipment associated with the project that will be placed within or adjacent to the receiving water.

The new outfall in our permit will have an adjacent sediment treatment pond designed for a 100 year 24 hour event.

Part D. Identify and rank (from increasing to decreasing potential threat to designated uses) the parameters of concern. *Parameters of concern are parameters in the effluent at concentrations greater than ambient concentrations in the receiving water. The applicant is responsible for identifying parameter concentrations in the effluent and DWQ will provide parameter concentrations for the receiving water. More information is available in Section 3.3.3 of the Implementation Guidance.*

Parameters of Concern:

Rank	Pollutant	Ambient Concentration	Effluent Concentration
1	TDS		<2,400 mg/l/day
2	TSS		<70 mg/l/day
3	PH		between 6.5-9
4	Oil & Grease		<10 mg/l/day
5			

Pollutants Evaluated that are not Considered Parameters of Concern:

Pollutant	Ambient Concentration	Effluent Concentration	Justification

Part E. Alternative Analysis Requirements of a Level II

Antidegradation Review. *Level II ADRs require the applicant to determine whether there are feasible less-degrading alternatives to the proposed project. More information is available in Section 5.5 and 5.6 of the Implementation Guidance.*

E1. The UPDES permit is being renewed without any changes to flow or concentrations. Alternative treatment and discharge options including changes to operations and maintenance were considered and compared to the current processes. No economically feasible treatment or discharge alternatives were identified that were not previously considered for any previous antidegradation review(s).

☐ **Yes** (Proceed to Part F)

☒ **No or Does Not Apply** (Proceed to E2)

E2. Attach as an appendix to this form a report that describes the following factors for all alternative treatment options (see 1) a technical description of the treatment process, including construction costs and continued operation and maintenance expenses, 2) the mass and concentration of discharge constituents, and 3) a description of the reliability of the system, including the frequency where recurring operation and maintenance may lead to temporary increases in discharged pollutants. Most of this information is typically available from a Facility Plan, if available.

Report Name: Appendix A and B

E3. Describe the proposed method and cost of the baseline treatment alternative. The baseline treatment alternative is the minimum treatment required to meet water quality based effluent limits (WQBEL) as determined by the preliminary or final wasteload analysis (WLA) and any secondary or categorical effluent limits.

Report Name: Appendix A and B

E4. Were any of the following alternatives feasible and affordable?

Alternative	Feasible	Reason Not Feasible/Affordable
Pollutant Trading	Yes	Participating in Colorado Salinity Project
Water Recycling/Reuse	No	Remote Location
Land Application	No	Infeasible due to storm events
Connection to Other Facilities	No	Location remote not feasible
Upgrade to Existing Facility	No	The current facility is being upgraded
Total Containment	No	Not feasible due to unpredictable storm events
Improved O&M of Existing Systems	No	Project is an upgrade to existing facility
Seasonal or Controlled Discharge	No	Existing project is a seasonal project for discharge
New Construction	No	The project is new construction
No Discharge	No	Not feasible due to possible large storm events

E5. From the applicant's perspective, what is the preferred treatment option?

The preferred treatment option is to provide a sediment pond for a 100 year 24 hour event. This would be the least degrading alternative.

E6. Is the preferred option also the least polluting feasible alternative?

☒ **Yes**

☐ **No**

If no, what were less degrading feasible alternative(s)?

If no, provide a summary of the justification for not selecting the least polluting feasible alternative and if appropriate, provide a more detailed justification as an attachment.

Part F. Optional Information

F1. Does the applicant want to conduct optional public review(s) in addition to the mandatory public review? Level II ADRs are public noticed for a thirty day comment period. More information is available in Section 3.7.1 of the Implementation Guidance.

☒ No

☐ Yes

F2. Does the project include an optional mitigation plan to compensate for the proposed water quality degradation?

☐ No

☒ Yes

Report Name: As Part of UPDES UT0025593, Dugout Canyon Mine participates in a Colorado River Salinity Offset program administered by the Utah Division of Water Quality (DWQ). Dugout Canyon Mine contributes monies through the DWQ to a fund established by the Colorado River Basin Salinity Control Forum for the purpose of defraying the cost of construction and operation of specific salinity offset project within the Colorado River Basin. The amount of the contribution to the Salinity Offset program is based on the concept of offsetting the net discharge of TDS (salt) from the Dugout Canyon Mine (total number of tons of TDS (salt) minus the permitted TDS tons Dugout anticipated discharging on a daily basis) against a "bank" of tons of TDS determined by the cost of removal of a similar number of tons of TDS from the Colorado River system. The cost per ton allocated to the bank is based on the cost of removing a ton of salt from the Price River Drainage through the construction and implementation of improved irrigation and irrigation water delivery systems.

Part G. Certification of Antidegradation Review

G1. Applicant Certification

The form should be signed by the same responsible person who signed the accompanying permit application or certification.

Based on my inquiry of the person(s) who manage the system or those persons directly responsible for gathering the information, the information in this form and associated documents is, to the best of my knowledge and belief, true, accurate, and complete.

Print Name: David Spillman

Signature: David Spillman

Date: 6/1/15

G2. DWO Approval

To the best of my knowledge, the ADR was conducted in accordance with the rules and regulations outlined in UAC R-317-2-3.

Water Quality Management Section

Print Name: _____

Signature: _____

Date: _____

Appendix A

**E2.**

The treatment process considered are a sediment pond for a 25 year 6 hour event, a sediment pond for a 100 year 6 hour event and a sediment pond for a 100 year 24 hour event. Dugout has chosen to provide a sediment pond designed for a 100 year 24 hour event. See Appendix B for the technical description, treatment process and the mass and concentration of the discharge constituents to the pond and the reliability of the system for all three options. The new sediment pond will receive quarterly inspections and one annual pond certification.

E3.

The baseline treatment would be to provide a sediment pond (Appendix B) for a 25 year 6 hour event. Discharges of water from disturbed areas will be in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining contained in the 40 CFR part 434. All sediment control measures, impoundments and discharge structures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 732, 742 and 760 of the approved M & RP.

Appendix B

**Dugout Canyon Mine
Refuse Pile
Runoff and Sediment Control Design Report
DRAFT**

Canyon Fuel Company
Dugout Mine
Wellington, Utah

August 2013



EarthFax EarthFax Engineering, Inc.

Engineers / Scientists
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Canyon Fuel Company
Dugout Canyon Mine

Refuse Pile Runoff and Sediment Control Design Report
DRAFT
August 2013

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Attachment A – Hydrology Calculations

**DUGOUT CANYON MINE
REFUSE PILE
RUNOFF AND SEDIMENT CONTROL DESIGN REPORT**

**CHAPTER 1
INTRODUCTION**

Canyon Fuel Company is planning the expansion of and existing refuse pile to service the Dugout Canyon Mine and other Canyon Fuel Company facilities. The refuse pile is located on Dugout Canyon Road 8 miles northwest of Wellington, Utah. To prevent adverse hydrologic impacts to the surrounding area, the mine will add to the existing runoff and sediment control system with additional berms, ditches, a swale, and a sedimentation pond.

The purpose of this document is to present design information for the runoff and sediment controls. A ditch and swale system will be installed around the perimeter of the refuse pile to contain sediment and runoff discharges from the disturbed areas and direct runoff into sedimentation ponds. Additionally a berm system will be installed to divert upstream runoff and sediment around the site. The runoff and sediment controls have been designed to conform to the applicable criteria outlined in the Utah Administrative Code Titles R645-300 and 301. However, Dugout Mine has requested that the berms, ditches, swales, and sedimentation ponds be designed to safely convey and detain a 100 year, 24 hour event and not the required 100 year, 6 hour event. This document has been prepared for Canyon Fuel Company by EarthFax Engineering Group, LLC, and contains the following information:

- Location and background information;
- Hydrologic analyses to determine runoff and sediment discharge for both the regulator design storm event and the requested design storm event;
- Sediment control design criteria;
- Berms, ditches, swale, and sedimentation pond construction drawings.

Engineering calculations are included as an attachment to this document.

CHAPTER 2

LOCATION AND BACKGROUND INFORMATION

The general layout of the proposed operational refuse pile is shown on Sheet 1. The total developed watershed includes the boundary of the refuse pile, approximately 19.976 acres. An existing ditch along the west and north side of the refuse pile will divert all upstream runoff around the refuse pile. An existing sedimentation pond (SP-1) has been evaluated to insure it will safely control a 100-year, 24-hour event for the proposed refuse pile layout. The access road for SP-1 and drainage ditch 5 (DD-5) will be moved to allow for expansion of the refuse pile. Due to grading and elevations at the site a proposed operational secondary sedimentation pond (SP-2) will need to be constructed. SP-2 and the proposed operational ditches along the north and east side (DD-1 through DD-4 and DS-1) will be constructed to safely convey and detain the 100-year, 24-hour event. During the first stages of expansion the area contributing runoff to SP-2 will be larger than the final stages; due to this several watersheds will appear to overlap. Two constructed berms north and west of SP-2 will direct undisturbed runoff around the pond. Some of the area to be developed for the expansion of the refuse pile has not been previously developed. The topsoil will be removed and stockpiled on-site. Some of the material will be used to provide contemporaneous remediation along the northeast side of the refuse pile.

The storm water runoff and sedimentation system has been designed to safely convey site runoff as specified in the Utah Administrative Code Titles R645-301-742 and 751. Thus, the conveyance systems have been designed to comply with the following criteria:

- The conveyance system will safely convey and detain the runoff from a 100-year, 24-hour storm event due to a design request from Dugout Canyon Mine.
- The conveyance system will be evaluated for compliance to 100-year, 6-hour event.
- All of the side slopes of the refuse pile along the berm have been designed to prevent degradation and erosion of the refuse pile.
- Sedimentation ponds, berms, ditches, and swale will be installed according to engineering specifications.

CHAPTER 3

OPERATIONAL HYDROLOGY

3.1 Hydrology Introduction

Storm water discharge for the area was calculated using HydroCAD version 10.00. The curve number (CN) value used was assigned for the site soil types and type of development. According to Natural Resources Conservation Service a majority of the native soil types are categorized as Hydrologic Soil Group B soils. Due to the site being a refuse pile no vegetation is assumed to be left in the developed areas. Although some contemporaneous reclamation will occur as the site is developed, the operational hydrological design assumes that no contemporaneous reclamation will occur. Due to this all non-pond disturbed areas are assumed to have a CN value of 86 and pond areas have a CN value of 98. Undeveloped and reclaimed areas have or will have Pinyon and Juniper forested areas with sage brush in poor condition. Therefore, a conservative CN value of 71 was used within these areas.

Design storm magnitudes were taken from the National Oceanic and Atmospheric Administration (NOAA) ATLAS 14, Point Precipitation Frequency Estimates web page (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html). Site watershed areas and average slopes were calculated from 1-foot contour interval topographic map provided by Dugout Canyon Mine using AutoCAD 2014 software. All storm runoff calculations are included in Attachment A.

3.2 Drainage Area Characteristics

The drainage area contributing to the refuse pile watershed is delineated in Sheet 6 for operational watersheds and Sheet 10 for reclaimed watersheds. The area draining to the sedimentation ponds, ditches and swale will include all of the refuse pile. In addition the unpaved portions of the haul road, SP-1 access road, and approximately 0.05 acres of

undisturbed area that cannot be reasonably diverted will also contribute runoff and sediment to the sedimentation ponds.

Developed Watershed-1 (DW-1) consists of the 0.535 acres at the northwest corner of the refuse pile that drains into Drainage Ditch 1(DD-1) and includes a portion the SP-1 access road. The slopes within DW-1 range from 1-50% with a majority of the slopes at 50%.

DW-2 consists of the 2.270 acres at the northwest corner of the refuse pile that drains into DD-2 and includes the haul road from the top of the refuse pile to the intersection with the SP-1 access road. The slopes within DW-2 range from 5-50% with a majority of the slopes at 50%.

DW-3 consists of the 5.527 acres along the west side of the refuse pile that drains into DD-5 and includes a majority of the SP-1 access road to the top of the refuse pile. The slopes within DW-3 range from 1-50% with a majority of the slopes at 50%.

DW-4 consists of the 6.083 acres along the northeast corner of the refuse pile that drains into DD-3 and DD-4. The slopes within DW-4 range from 5-50% with a majority of the slopes at 50%.

DW-5 consists of the 4.686 acres along the southeast corner of the refuse pile that drains directly into SP-2. During the first stages of expansion the area contributing to SP-2 will include a portion of what will later become DW-3 and DW-6. The slopes within DW-5 range from 5-50% with a majority of the slopes at 50%.

DW-6 consists of the 0.626 acres along the south side of the refuse pile that drains directly into SP-1. The slopes within DW-6 range from 33-50% with a majority of the slopes at 50%.

DW-7 consists of the 0.606 acres included in SP-2 assuming the pond is full to capacity.

DW-8 consists of the 0.207 acres west, south, and east of SP-2 that drains directly into SP-2 and includes the SP-2 access road. The slopes within DW-8 range from 1-50%.

DW-9 consists of the 0.604 acres included in SP-1 assuming the pond is full to capacity.

DW-10 consists of the 0.303 acres along the west and south side of SP-1 that drain directly into SP-1. The slopes within DW-10 range from 5-33%.

Undisturbed Watershed 1 (UW-1) consists of the 17.785 acres north of the site that drains into Undisturbed Ditch 1 (UD-1). The slopes within UW-1 range from 1-50%, with poor vegetation.

UW-2 consists of the 0.135 acres at the northeast end of SP-2 that drains into Undeveloped Berm 1 (UB-1). The slopes within UW-2 range from 15-50%, with poor vegetation.

UW-3 consists of the 0.143 acres at the southwest end of SP-2 that drains into UB-2. The slopes within UW-3 range from 20-50%, with poor vegetation.

Runoff from DW-1 will flow into DD-1 and east to Diversion Swale 1 (DS-1). DS-1 will convey runoff across the lower section of the haul road and into DD-3. Runoff from DW-2 will flow north and then east through DD-2 where runoff will be conveyed into DD-3. Runoff from DW-4 will flow into DD-3 along the east side of the refuse pile and then into DD-4. From DD-4 runoff will flow into SP-2. Runoff from DW-5 will drain directly into SP-2. As the refuse pile is expanded the contributing runoff from DW-5 will decrease as DW-5's area decreases.

Overflow from SP-2 will flow out of the emergency spillway (SPO-2) and into an existing drainage ditch.

Runoff from DW-3 will flow into DD-5 and south into DD-6. From DD-6 runoff will flow east into SP-1. Runoff from DW-6, DW-10 will flow directly into SP-1. Overflow from SP-1 will flow south through an existing emergency spillway (SPO-1) and then into an existing drainage ditch.

Reclaimed Watershed 1 (RW-1) consists of the 21.689 acres along the north of the site that drains into Reclaimed Ditch 1 (RD-1). The slopes within RW-1 range from 1-50%, with poor vegetation.

RW-2 consists of the 0.512 acres along the northeast corner of the refuse pile that drains into the reclaimed section of DD-3. The slopes within RW-2 range from 5-50% with a majority of the slopes at 50%.

RW-3 consists of the 1.540 acres along the south end of the refuse pile that drains into the reclaimed portions of SP-1 and through SPO-1. The slopes within RW-3 range from 2-50%.

3.3 Runoff Volume Calculations

Results of the runoff calculations are provided in Attachment A. HydroCAD was used in conjunction with precipitation data from The National Oceanic and Atmospheric Administration Atlas 14 to calculate runoff for the site. The runoff volumes are presented in the HydroCAD worksheets. Total runoff volume discharge within DW-3, DW-6, DW-9, and DW-10 which drain to SP-1 resulting from the 100-year, 24-hour storm event is 30,806 cubic feet. Total discharge from the 100-year, 6-hour event is 20,840 cubic feet. Total runoff volume discharge within DW-1, DW-2, DW-4, DW-5, DW-7, and DW-8 which drain to SP-2 resulting from the

100-year, 24-hour storm event is 60,392 cubic feet. Total discharge from the 100-year, 6-hour event is 40,452 cubic feet. Total runoff volume discharge within UW-1 and UW-2 resulting from the 100-year, 24-hour storm event are 218 cubic feet for both watersheds. Total discharge from the 100-year, 6-hour event for UW-1 and UW-2 are 87 cubic feet and 131 cubic feet, respectively.

Reclaimed runoff volumes for RW-1 are 32,583 cubic feet for the 100-year, 24-hour storm event and 16,422 cubic feet for the 100-year, 6-hour storm event. RW-2 runoff volumes are 784 cubic feet for the 100-year, 24-hour storm event and 392 cubic feet for the 100-year, 6-hour storm event. RW-3 runoff volumes are 2,352 cubic feet for the 100-year, 24-hour storm event and 1,176 cubic feet for the 100-year, 6-hour storm event.

3.4 Sediment Volume Calculations

The average annual anticipated sediment yield from the refuse pile was calculated using an assumed value of 0.05 acre-feet per acre per year from section 742.200 of the Refuse Pile Amendment for the Dugout Canyon Mine NOI Permit.

The average annual sediment yield in acre-feet per acre for each watershed was multiplied by that watershed's area to find the annual volume of sediment participated from the area. Finally, the volumes for each watershed were summed to determine the total annual yield of the area draining into SP-1 and SP-2. The maximum calculated annual sediment yield for the area draining to SP-1 and SP-2 is 15,377 cubic feet and 31,335 cubic feet, respectively.

CHAPTER 4

SEDIMENT CONTROL DESIGN

4.1 Sedimentation Pond Capacities

SP-1 is an existing sedimentation pond that will have the access road and the contributing ditch moved west to allow for more material to be placed on the refuse pile. Additionally, portions of the north side of the pond will be filled in to allow for construction of an access road and ditch. SP-1 has been evaluated and will safely detain runoff from a 100-year, 24-hour storm event from contributing watersheds, 30,806 cubic feet, and five years of predicted sediment yield, 76,885 cubic feet, for a total of 107,691 cubic feet. Sediment will be removed when the four year sediment capacity of 61,508 cubic feet or approximately 5,899.5 feet elevation is reached. The stage-capacity curve for SP-1 is shown in Table 1.

SP-2 has been designed to safely detain runoff from a 100-year, 24-hour storm event from contributing watersheds, 60,392 cubic feet, and one year of predicted sediment yield, 31,335 cubic feet, for a total of 91,727 cubic feet. Sediment will be removed when the 60% sediment capacity of 18,801 cubic feet or approximately 5,862.0 feet elevation is reached. The stage-capacity curve for SP-2 is shown in Table 2.

4.2 Runoff Conveyance System Details

Peak flows for the berms, ditches, and swale were calculated using HydroCAD version 10.00 and FlowMaster version 6.0. The results of these calculations are presented in Attachment A. For design details, see Sheets 4 and 9. The conveyance system was designed to safely convey the runoff volume resulting from a 100-year, 24-hour event. To insure compliance with Utah Administrative Code Titles R645-301-742 the conveyance system was evaluated using the 100-year, 6-hour event. The 100-year, 24-hour event velocities, depths, and flows are greater

than the 100-year, 6-hour event velocities, depths, and flows. Therefore, the 100-year, 24-hour event was used for the design. Velocities above 5.00 fps require rock lining according to the attached U.S. Department of Transportation Table in Attachment A. For conveyance system capacities for the velocities, depths, and freeboard for both storm events, see Table 4 and 5 and Attachment A.

The peak discharge along DD-1 was calculated to be 1.22 cfs with a maximum velocity of 3.27 fps and a maximum depth of 0.63 ft. DD-1 will be constructed with a minimum height of 1 foot and 2 horizontal to 1 vertical side slopes with available fill material that is non-deleterious.

The peak discharge along DD-2 was calculated to be 4.91 cfs with a maximum velocity of 5.51 fps and a maximum depth of 0.81 ft. DD-2 will be constructed with a minimum height of 1.33 feet and 1.5 horizontal to 1 vertical side slopes with 2 inch diameter rock.

The peak discharge along DD-3 was calculated to be 17.93 cfs with a maximum velocity of 4.12 fps and a maximum depth of 1.36 ft. DD-3 will be constructed with a minimum height of 2.5 feet and 3 horizontal to 1 vertical side slopes with available fill material that is non-deleterious.

The peak discharge along DD-4 was calculated to be 17.93 cfs with a maximum velocity of 8.72 fps and a maximum depth of 0.31 ft. DD-4 will be constructed with a minimum height of 1 foot and 2 horizontal to 1 vertical side slopes and an 8 foot wide bottom. Due to the velocity 9 inch diameter rock will be used to line the ditch.

The peak discharge along DD-5 was calculated to be 12.06 cfs with a maximum velocity of 6.03 fps and a maximum depth of 1.36 ft. DD-5 will be constructed with a minimum height of 3 feet and 2 horizontal to 1 vertical side slopes with 3 inch diameter rock.

The peak discharge along DD-6 was calculated to be 12.06 cfs with a maximum velocity of 7.74 fps and a maximum depth of 0.95 ft. DD-6 will be constructed with a minimum height of 1.5 feet and 2 horizontal to 1 vertical side slopes and a 6 inch diameter rock lining.

The peak discharge along DS-1 was calculated to be 1.22 cfs with a maximum velocity of 1.51 fps and a maximum depth of 0.09 ft. DS-1 will be constructed with a minimum height of 0.5 feet and 20 horizontal to 1 vertical side slopes and a bottom width of 10 feet. Although no rock lining is required the swale will cross the haul road and will be constructed of road base or other suitable road material.

The peak discharge along UB-1 was calculated to be 0.10 cfs with a maximum velocity of 2.21 fps and a maximum depth of 0.14 ft. UB-1 will be constructed with a minimum height of 0.5 feet and 2 horizontal to 1 vertical side slopes with available fill material that is non-deleterious.

The peak discharge along UB-2 was calculated to be 0.11 cfs with a maximum velocity of 2.26 fps and a maximum depth of 0.15 ft. UB-2 will be constructed with a minimum height of 0.5 feet and 2 horizontal to 1 vertical side slopes with available fill material that is non-deleterious.

SPO-1 is an existing spillway and was evaluated with a peak discharge of 4.84 cfs with a maximum velocity of 5.53 fps and a maximum depth of 0.20 ft. SPO-1 has been constructed with a minimum height of 0.5 feet and 2 horizontal to 1 vertical side slopes and a 6 foot bottom. SPO-1 is currently constructed with rock larger than the required 2 inch diameter. Therefore, SPO-1 will not need to be altered.

The peak discharge along SPO-2 was calculated to be 7.42 cfs with a maximum velocity of 8.39 fps and a maximum depth of 0.39 ft. SPO-2 will be constructed with a minimum height

of 1 foot and 2 horizontal to 1 vertical side slopes and a 4 foot wide bottom. 6 inch diameter rock will be used to line the spillway to prevent erosion.

The peak discharge along RD-1 was calculated to be 6.34 cfs with a maximum velocity of 6.91 fps and a maximum depth of 1.14 ft. RD-1 will be constructed with a minimum height of 2 feet and 2 horizontal to 1 vertical side slopes. In sections of RD-1 that are steeper than 10% 4 inch diameter rock will line the ditch.

The peak discharge along RD-2 was calculated to be 0.38 cfs with a maximum velocity of 1.13 fps and a maximum depth of 0.08 ft. RD-2 will be constructed with a minimum height of 2 feet, 2 horizontal to 1 vertical side slopes, and an 8-foot bottom section.

The peak discharge along RD-3 was calculated to be 1.13 cfs with a maximum velocity of 3.43 fps and a maximum depth of 0.11 ft. RD-3 will be constructed with a minimum height of 2 feet, 2 horizontal to 1 vertical side slopes, and a 6-foot bottom section.

CHAPTER 5

RECLAMATION HYDROLOGY

Reclamation of the refuse pile will be performed according to specifications and standards outlined in the Dugout Canyon Mine NOI Permit. As topsoil and subsoil are removed from the expansion to the south the topsoil and subsoil will be placed along the northeast side of the refuse pile. For reclamation layout, see Sheet 7. During reclamation DD-3 will be filled in with subsoil and topsoil. However, even when filled some sections of DD-3 will remain. Portions of the outside side slope of DD-3 will be removed as indicated on Sheet 7 to allow runoff to flow away from the reclaimed refuse pile. RW-2 represents the largest contributing watersheds to DD-3. For this reason RW-2 was used to model the maximum flow rate through (RD-2) one of these side slope removal areas, see the narrative above, Table 4 and 5, and Sheet 9 for details.

CHAPTER 6

REFERENCES

Heastad Methods, Inc. 1998. FlowMaster I Computer Program, Version 6.0 Waterbury, Connecticut.

HydroCAD Software Solutions LLC. 2013. HydroCAD Version 10.00 Chocorua, New Hampshire.

National Oceanic and Atmospheric Administration, 2013. *Point Precipitation Frequency Estimates from NOAA ATLAS 14*. <http://hdsc.nws.noaa.gov/hdsc/index.html>

Natural Resources Conservation Service, Web Soil Survey, Carbon Area, Utah, Parts of Carbon and Emery Counties Ver. 4, 2013,
<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

U.S. Department of Transportation. 1978. Use of Riprap for Bank Protection. Hydrology Engineering Circular No. 11. Federal Highway Administration. Washington, D.C.

TABLE 1

Sedimentation Pond-1 Staged Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,894.50	0		
5,895.00	4,583	1,146	1,146
5,896.00	10,205	7,394	8,540
5,897.00	13,585	11,895	20,435
5,898.00	15,653	14,619	35,054
5,899.00	17,740	16,697	51,750
5,900.00	19,849	18,795	70,545
5,901.00	21,972	20,911	91,455
5,902.00	24,114	23,043	114,498
Total			114,498

Surface area at given elevations based on AutoCAD topography of site.

TABLE 2

Sedimentation Pond-2 Staged Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,859.90	0		
5,860.00	6,718	336	336
5,861.00	9,106	7,912	8,248
5,862.00	11,806	10,456	18,704
5,863.00	14,494	13,150	31,854
5,864.00	17,310	15,902	47,756
5,865.00	20,258	18,784	66,540
5,866.00	23,306	21,782	88,322
5,866.25	24,092	5,925	94,247
5,867.00	26,413	18,939	113,186
Total			113,186

Surface area at given elevations based on AutoCAD topography of site.

TABLE 3

Overflow Structure Depths, Velocities, and Rock Lining Size

Emergency Spillway	25-Yr, 6-Hr Event Maximum Depth (ft)	25-Yr, 6-Hr Event Maximum Velocity (fps)	Rock Size (Dia. in)
SPO-1	0.20	5.53	2
SPO-2	0.39	8.39	9

Depths and velocities based on FlowMaster and assumed elevations from AutoCAD topography of site.

Rock sizing based on U.S. Department of Transportation Table.

TABLE 4

Diversion Structure Velocities and Rock Lining Sizing

Diversion Structure	100-Yr, 6-Hr Event Maximum Velocity (fps)	100-Yr, 24-Hr Event Maximum Velocity (fps)	100-Yr, 6-Hr Event Rock Size (Dia. in)	100-Yr, 24-Hr Event Rock Size (Dia. in)
DD-1	3.24	3.27	Not Required	Not Required
DD-2	5.26	5.51	2	2
DD-3	4.38	4.12	Not Required	Not Required
DD-4	8.57	8.72	9	9
DD-5	5.98	6.03	3	3
DD-6	7.68	7.74	6	6
DS-1	1.49	1.51	Not Required	Not Required
RD-1	6.12	6.91	4	4
RD-2	1.00	1.13	Not Required	Not Required
RD-3	2.72	3.43	Not Required	Not Required
UB-1	2.02	2.21	Not Required	Not Required
UB-2	2.09	2.26	Not Required	Not Required
UD-1	5.51	6.18	3	4

Velocities based on FlowMaster and assumed elevations from AutoCAD topography of site.

Rock sizing based on U.S. Department of Transportation Table.

TABLE 5
Diversion Structure Depths

Diversion Structure	100-Yr, 6-Hr Event Maximum Depth (ft)	100-Yr, 24-Hr Event Maximum Depth (ft)	100-Yr, 6-Hr Event Freeboard (ft)	100-Yr, 24-Hr Event Freeboard (ft)
DD-1	0.62	0.63		
DD-2	0.70	0.81		
DD-3	1.59	1.36		
DD-4	0.30	0.31		
DD-5	1.34	1.35		
DD-6	0.87	0.95		
DS-1	0.09	0.09		
RD-1	0.95	1.14		
RD-2	0.07	0.08		
RD-3	0.10	0.11		
UB-1	0.13	0.14		
UB-2	0.13	0.15		
UD-1	0.81	0.97		

Depths based on FlowMaster and assumed elevations from AutoCAD topography of site.



NOAA Atlas 14, Volume 1, Version 5

Location name: Utah, US*

Coordinates: 39.6141, -110.6110

Elevation: 5926ft*

* source: Google Maps



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchon

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.124 (0.107-0.149)	0.159 (0.138-0.191)	0.218 (0.187-0.261)	0.271 (0.232-0.324)	0.354 (0.294-0.423)	0.428 (0.347-0.513)	0.514 (0.408-0.618)	0.614 (0.471-0.745)	0.773 (0.565-0.953)	0.917 (0.645-1.15)
10-min	0.189 (0.163-0.228)	0.242 (0.210-0.290)	0.333 (0.285-0.397)	0.413 (0.352-0.493)	0.539 (0.447-0.643)	0.651 (0.528-0.780)	0.783 (0.620-0.940)	0.935 (0.716-1.13)	1.18 (0.880-1.45)	1.39 (0.981-1.75)
15-min	0.235 (0.202-0.280)	0.300 (0.280-0.360)	0.412 (0.353-0.492)	0.512 (0.437-0.611)	0.668 (0.554-0.798)	0.807 (0.654-0.967)	0.970 (0.789-1.17)	1.16 (0.888-1.41)	1.46 (1.07-1.80)	1.73 (1.22-2.17)
30-min	0.316 (0.272-0.377)	0.404 (0.350-0.484)	0.555 (0.475-0.662)	0.689 (0.588-0.823)	0.899 (0.746-1.07)	1.09 (0.881-1.30)	1.31 (1.04-1.57)	1.56 (1.20-1.89)	1.97 (1.44-2.42)	2.33 (1.64-2.92)
60-min	0.391 (0.336-0.466)	0.500 (0.434-0.599)	0.687 (0.588-0.819)	0.852 (0.728-1.02)	1.11 (0.923-1.33)	1.35 (1.09-1.61)	1.62 (1.28-1.94)	1.93 (1.48-2.34)	2.43 (1.78-3.00)	2.88 (2.03-3.61)
2-hr	0.456 (0.397-0.536)	0.575 (0.500-0.674)	0.782 (0.680-0.892)	0.935 (0.801-1.09)	1.21 (1.01-1.42)	1.46 (1.19-1.72)	1.75 (1.39-2.07)	2.08 (1.81-2.49)	2.63 (1.93-3.21)	3.13 (2.21-3.89)
3-hr	0.509 (0.447-0.590)	0.637 (0.559-0.740)	0.821 (0.720-0.953)	0.990 (0.862-1.15)	1.25 (1.07-1.46)	1.48 (1.24-1.73)	1.77 (1.44-2.08)	2.10 (1.67-2.50)	2.65 (2.02-3.22)	3.15 (2.31-3.93)
6-hr	0.631 (0.560-0.717)	0.780 (0.696-0.892)	0.975 (0.864-1.11)	1.14 (1.01-1.30)	1.38 (1.20-1.58)	1.59 (1.36-1.83)	1.85 (1.56-2.15)	2.16 (1.79-2.53)	2.69 (2.16-3.25)	3.18 (2.48-3.97)
12-hr	0.769 (0.695-0.859)	0.949 (0.857-1.06)	1.16 (1.04-1.30)	1.34 (1.20-1.50)	1.59 (1.40-1.78)	1.79 (1.56-2.02)	2.00 (1.72-2.28)	2.27 (1.93-2.61)	2.75 (2.29-3.28)	3.21 (2.61-4.01)
24-hr	0.971 (0.882-1.08)	1.20 (1.09-1.34)	1.46 (1.32-1.63)	1.66 (1.50-1.85)	1.93 (1.74-2.15)	2.14 (1.91-2.39)	2.35 (2.09-2.63)	2.56 (2.26-2.87)	2.83 (2.46-3.31)	3.24 (2.62-4.05)
2-day	1.13 (1.02-1.26)	1.39 (1.26-1.55)	1.68 (1.52-1.88)	1.92 (1.73-2.14)	2.22 (1.99-2.48)	2.46 (2.19-2.75)	2.69 (2.38-3.02)	2.93 (2.56-3.29)	3.23 (2.80-3.66)	3.46 (2.96-4.09)
3-day	1.22 (1.11-1.36)	1.51 (1.37-1.68)	1.83 (1.65-2.03)	2.08 (1.87-2.31)	2.42 (2.16-2.69)	2.67 (2.37-2.98)	2.93 (2.58-3.28)	3.18 (2.78-3.58)	3.52 (3.03-3.98)	3.77 (3.22-4.37)
4-day	1.32 (1.20-1.47)	1.63 (1.48-1.81)	1.97 (1.78-2.19)	2.24 (2.02-2.49)	2.61 (2.33-2.90)	2.88 (2.56-3.21)	3.16 (2.79-3.54)	3.44 (3.00-3.86)	3.81 (3.27-4.30)	4.08 (3.47-4.64)
7-day	1.54 (1.39-1.74)	1.90 (1.71-2.15)	2.31 (2.07-2.59)	2.62 (2.35-2.95)	3.05 (2.72-3.44)	3.37 (2.99-3.81)	3.70 (3.25-4.19)	4.02 (3.50-4.58)	4.44 (3.82-5.10)	4.75 (4.04-5.49)
10-day	1.76 (1.59-1.95)	2.18 (1.97-2.42)	2.64 (2.39-2.93)	3.00 (2.71-3.33)	3.48 (3.12-3.85)	3.84 (3.42-4.26)	4.19 (3.71-4.66)	4.54 (4.00-5.06)	4.98 (4.34-5.60)	5.31 (4.58-6.01)
20-day	2.17 (1.97-2.42)	2.70 (2.45-3.01)	3.30 (2.99-3.68)	3.77 (3.41-4.19)	4.38 (3.94-4.88)	4.85 (4.33-5.40)	5.31 (4.70-5.93)	5.76 (5.06-6.46)	6.35 (5.50-7.17)	6.78 (5.81-7.70)
30-day	2.59 (2.36-2.87)	3.21 (2.92-3.56)	3.88 (3.54-4.29)	4.40 (3.99-4.85)	5.06 (4.57-5.59)	5.55 (4.98-6.13)	6.02 (5.38-6.68)	6.48 (5.74-7.22)	7.05 (6.18-7.92)	7.47 (6.48-8.43)
45-day	3.12 (2.85-3.45)	3.87 (3.53-4.27)	4.68 (4.26-5.16)	5.30 (4.81-5.84)	6.09 (5.51-6.71)	6.66 (6.00-7.35)	7.22 (6.47-7.97)	7.74 (6.90-8.57)	8.39 (7.41-9.33)	8.84 (7.76-9.87)
60-day	3.65 (3.33-4.03)	4.52 (4.13-5.00)	5.49 (5.00-6.05)	6.22 (5.65-6.84)	7.15 (6.46-7.88)	7.82 (7.04-8.64)	8.48 (7.58-9.38)	9.10 (8.08-10.1)	9.86 (8.67-11.0)	10.4 (9.07-11.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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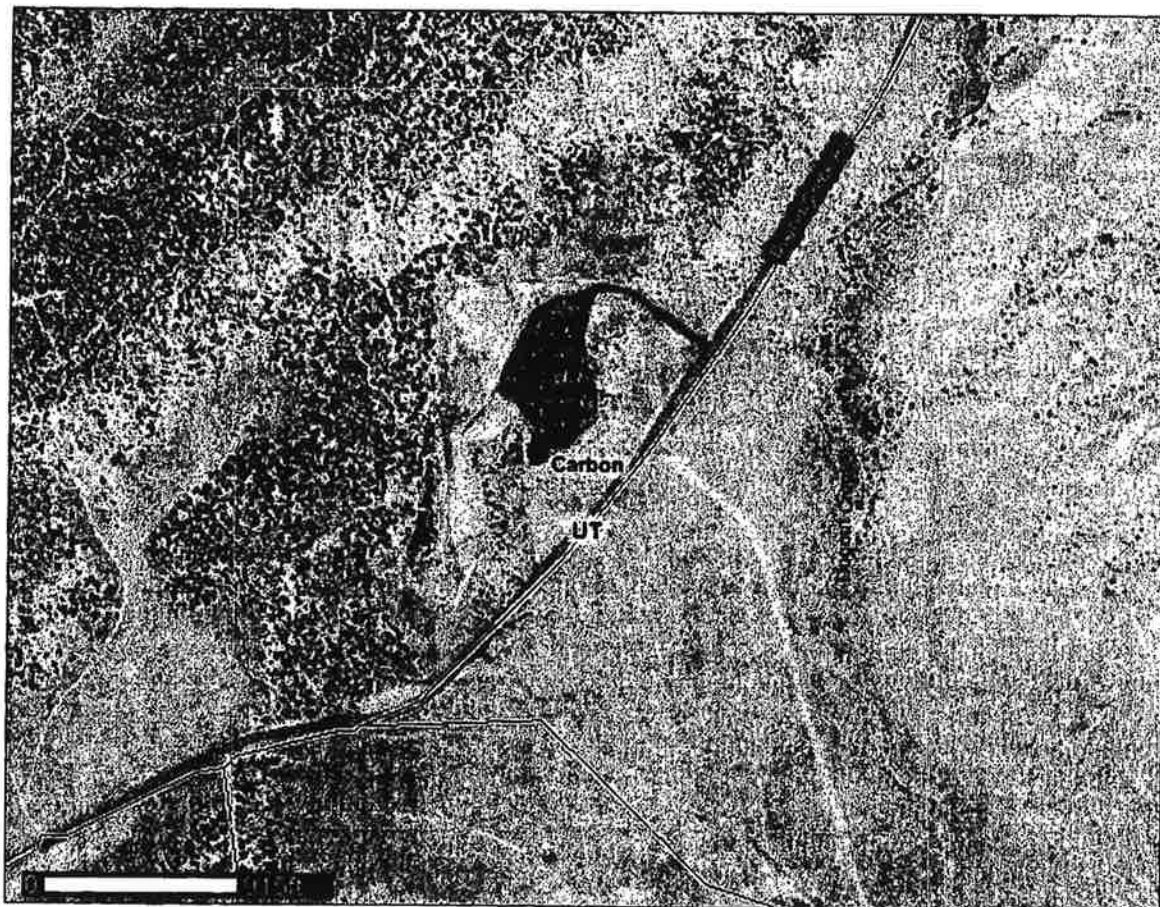


NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties



February 25, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://soils.usda.gov/sqi/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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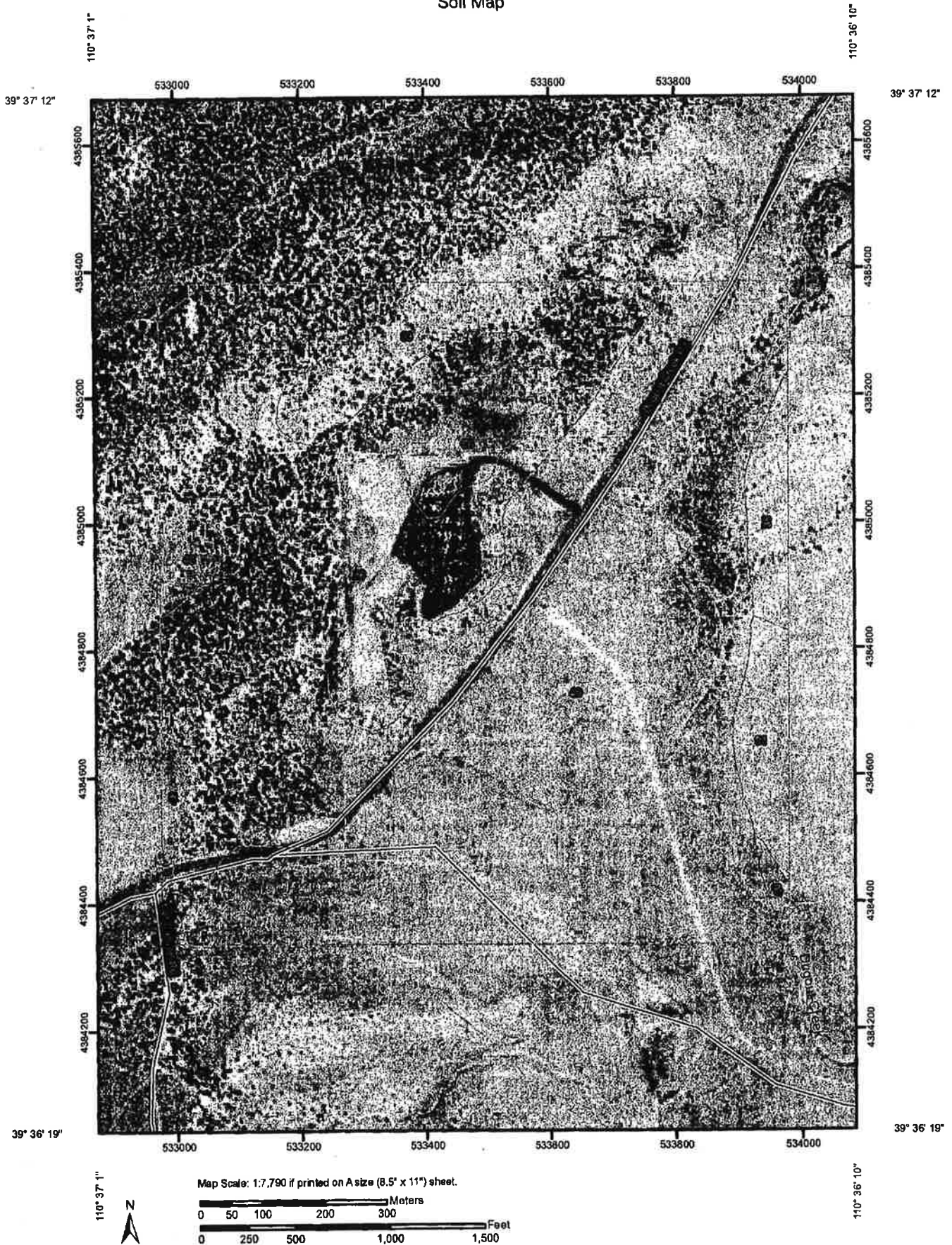
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




































Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

	Area of Interest (AOI)		Very Stony Spot
	Soils		Wet Spot
	Soil Map Units		Other
	Special Point Features		Special Line Features
	Blowout		Gully
	Borrow Pit		Short Steep Slope
	Clay Spot		Other
	Closed Depression		Political Features
	Gravel Pit		Cities
	Gravelly Spot		Water Features
	Landfill		Streams and Canals
	Lava Flow		Transportation
	Marsh or swamp		Rails
	Mine or Quarry		Interstate Highways
	Miscellaneous Water		US Routes
	Perennial Water		Major Roads
	Rock Outcrop		Local Roads
	Saline Spot		
	Sandy Spot		
	Saverey Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		
	Spoil Area		
	Stony Spot		

MAP INFORMATION

Map Scale: 1:7,790 if printed on A size (8.5" x 11") sheet.
The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 5, Sep 3, 2009

Date(s) aerial images were photographed: 8/29/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Erosion

This folder contains a collection of tabular reports that present soil erosion factors and groupings. The reports (tables) include all selected map units and components for each map unit. Soil erosion factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the surface horizon.

Report—RUSLE2 Related Attributes

Custom Soil Resource Report

RUSLE2 Related Attributes— Carbon Area, Utah, Parts of Carbon and Emery Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
33—Gerst-Badland-Rubbleland complex, 15 to 50 percent slopes								
Gerst	40	—	D	.28	2	41.6	37.4	21.0
Badland	25	—	D	—	—	—	—	0.0
Rubbleland	20	—	A	—	5	—	—	0.0
Rock outcrop	12	—	—	—	—	—	—	—
Strych	3	—	—	—	—	—	—	—
35—Gerst-Badland-Stormitt complex								
Gerst	55	—	D	.37	2	41.6	37.4	21.0
Badland	20	—	D	—	—	—	—	0.0
Stormitt	15	—	B	.17	2	58.7	17.8	23.5
Gerst	8	—	—	—	—	—	—	—
Rock outcrop	2	—	—	—	—	—	—	—
48—Haverdad loam, 1 to 8 percent slopes								
Haverdad	85	—	B	.28	5	42.4	38.1	19.5
Glenburg	5	—	—	—	—	—	—	—
Ravola	5	—	—	—	—	—	—	—
Billings	3	—	—	—	—	—	—	—
Haverdad, alkali, 0 to 3 percent slopes	2	—	—	—	—	—	—	—
49—Haverdad loam, alkali, 0 to 3 percent slopes								
Haverdad	90	—	B	.28	5	43.0	38.5	18.5
Glenberg	5	—	—	—	—	—	—	—
Haverdad	5	—	—	—	—	—	—	—
50—Haverdad loam, moist, 1 to 5 percent slopes								
Haverdad	90	—	B	.28	5	42.4	38.1	19.5
Glanberg	5	—	—	—	—	—	—	—
Haverdad, colder	5	—	—	—	—	—	—	—
66—Mivida gravelly fine sandy loam, 3 to 8 percent slopes								
Mivida	85	—	B	.24	2	69.2	16.3	14.5
Gerst	5	—	—	—	—	—	—	—
Haverdad	5	—	—	—	—	—	—	—
Strych	5	—	—	—	—	—	—	—

Custom Soil Resource Report

RUSLE2 Related Attributes— Carbon Area, Utah, Parts of Carbon and Emery Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
91—Ravola loam, 1 to 6 percent slopes, eroded								
Ravola	80	279	B	.28	5	37.4	42.6	20.0
Billings	5	—	—	—	—	—	—	—
Kilpack	5	—	—	—	—	—	—	—
Persayo	5	—	—	—	—	—	—	—
Ravola, 1 to 3 percent slopes	5	—	—	—	—	—	—	—
93—Ravola-Slickspots complex								
Ravola	70	351	B	.28	5	37.4	42.6	20.0
Slickspots	20	—	D	—	—	—	—	—
Billings	10	—	—	—	—	—	—	—

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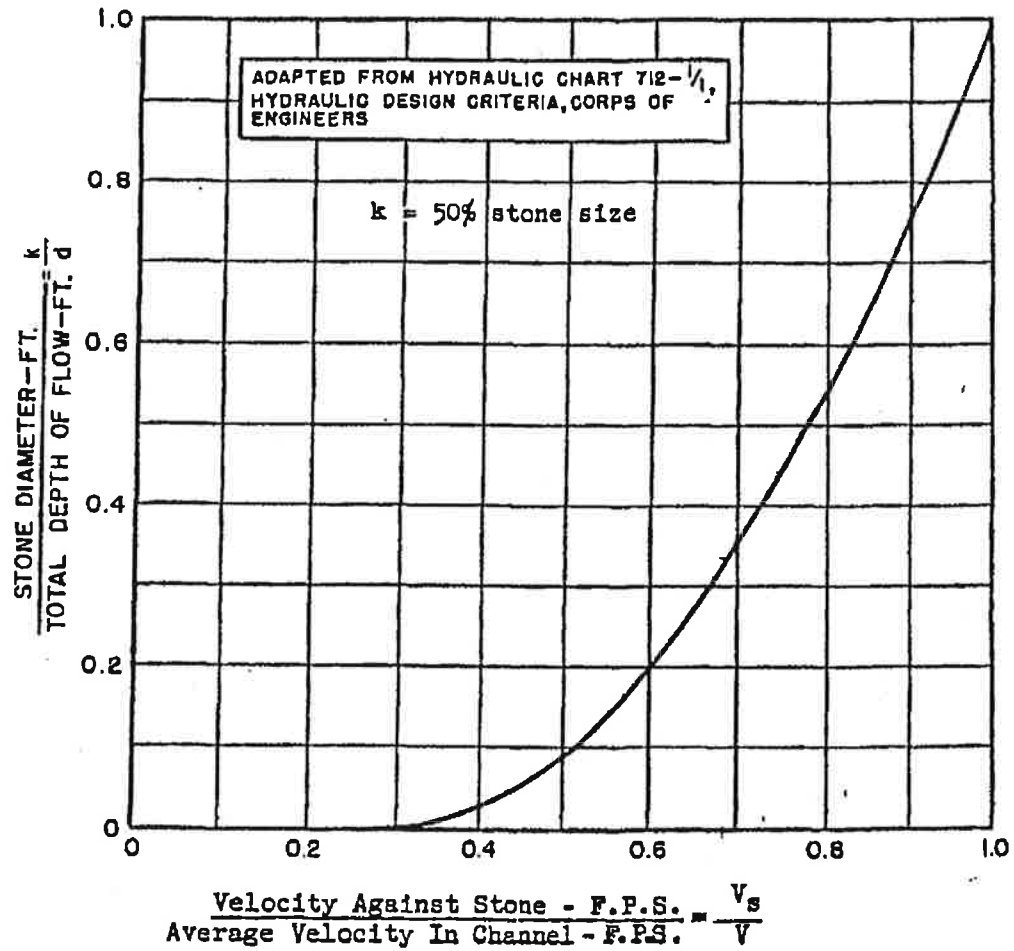


FIGURE 5-1 Velocity Against Stone on Channel Bottom (U.S. Department of Transportation, 1978).

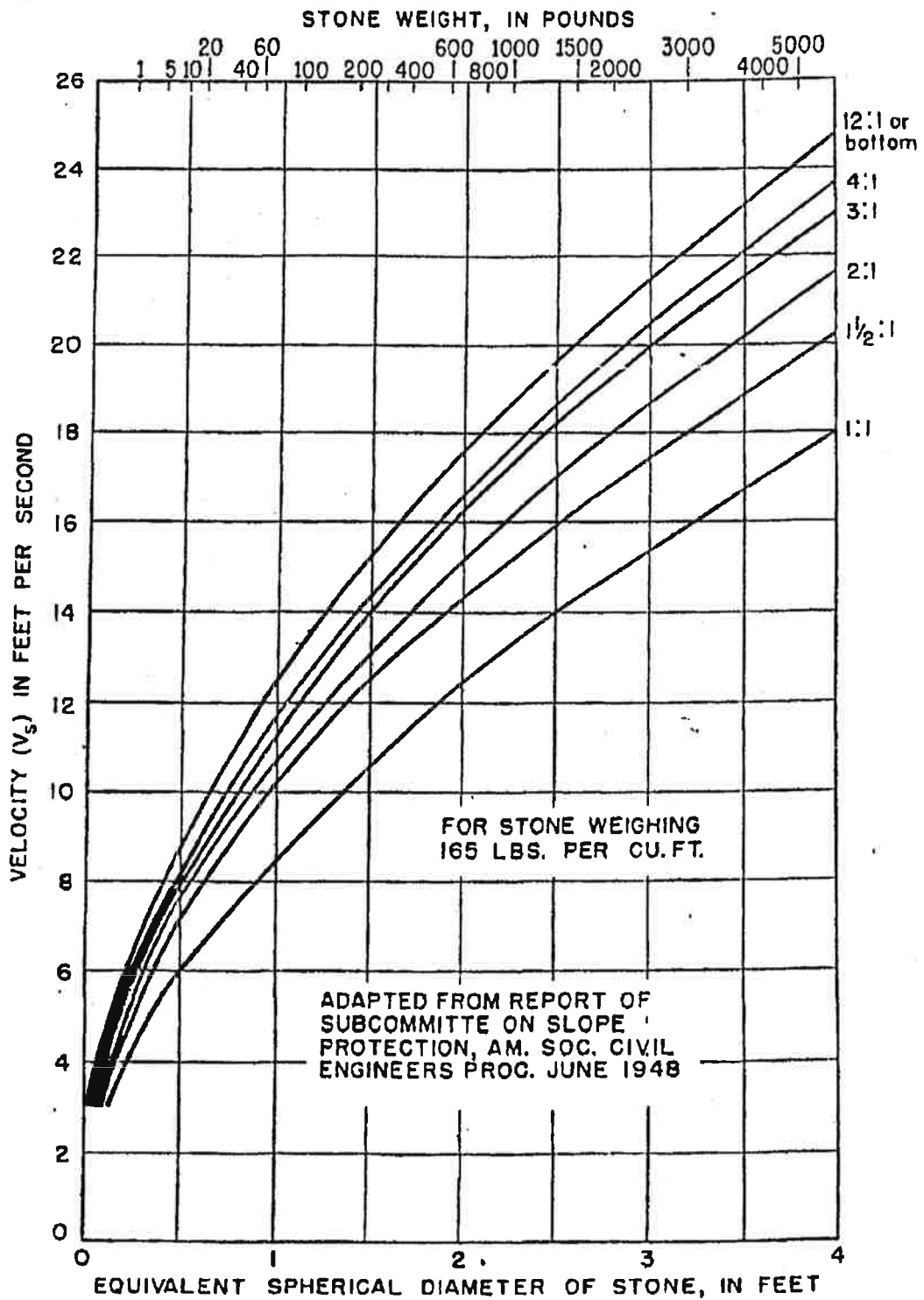


FIGURE 5-2 Size of Stone that will Resist Displacement for Various Velocities and Side Slopes (U.S. Department of Transportation, 1978).

100-year, 6-hour Event

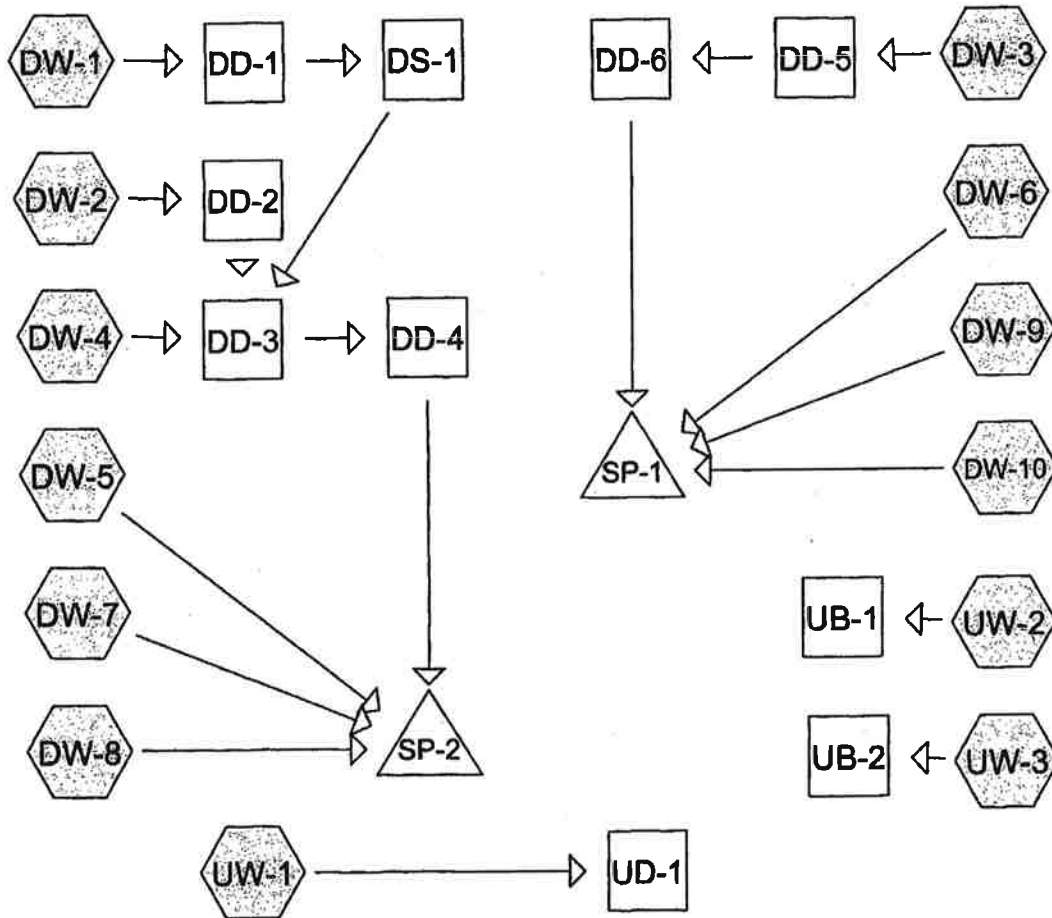
Label	Discharge (cfs)	Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
DD-1 Max. Depth	1.18	0.007	0.62	1.52
DD-1 Max. Velocity	1.18	0.053	0.43	3.24
DD-2 Max. Depth	4.74	0.080	0.70	4.84
DD-2 Max. Velocity	4.74	0.100	0.67	5.26
DD-3 Max. Depth	17.08	0.010	1.59	3.38
DD-3 Max. Velocity	17.08	0.020	1.40	4.38
DD-4 Max. Depth	17.08	0.167	0.30	6.50
DD-4 Max. Velocity	17.08	0.400	0.24	8.57
DD-5 Max. Depth	11.70	0.015	1.34	3.24
DD-5 Max. Velocity	11.70	0.077	0.99	5.98
DD-6 Max. Depth	11.70	0.150	0.87	7.68
DD-6 Max. Velocity	11.70	0.100	0.94	6.60
DS-1 Max. Depth	1.18	0.020	0.09	1.10
DS-1 Max. Velocity	1.18	0.050	0.07	1.49
RD-1 Max. Depth	3.90	0.008	0.95	2.15
RD-1 Max. Velocity	3.90	0.170	0.56	6.12
RD-2 Max. Depth	0.28	0.005	0.07	0.50
RD-2 Max. Velocity	0.28	0.050	0.03	1.00
RD-3 Max. Depth	0.77	0.030	0.10	1.31
RD-3 Max. Velocity	0.77	0.330	0.05	2.72
UB-1 Max. Depth	0.07	0.025	0.13	1.03
UB-1 Max. Velocity	0.07	0.150	0.09	2.02
UB-2 Max. Depth	0.08	0.025	0.13	1.07
UB-2 Max. Velocity	0.08	0.150	0.09	2.09
UD-1 Max. Depth	2.56	0.008	0.81	1.93
UD-1 Max. Velocity	2.56	0.170	0.48	5.51

100-year, 24-hour Event

Label	Discharge (cfs)	Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
DD-1 Max. Depth	1.22	0.007	0.63	1.53
DD-1 Max. Velocity	1.22	0.053	0.43	3.27
DD-2 Max. Depth	4.91	0.080	0.81	5.07
DD-2 Max. Velocity	4.91	0.100	0.77	5.51
DD-3 Max. Depth	17.93	0.010	1.36	3.18
DD-3 Max. Velocity	17.93	0.020	1.20	4.12
DD-4 Max. Depth	17.93	0.167	0.31	6.62
DD-4 Max. Velocity	17.93	0.400	0.24	8.72
DD-5 Max. Depth	12.06	0.015	1.36	3.26
DD-5 Max. Velocity	12.06	0.077	1.00	6.03
DD-6 Max. Depth	12.06	0.100	0.95	6.65
DD-6 Max. Velocity	12.06	0.150	0.88	7.74
DS-1 Max. Depth	1.22	0.020	0.09	1.11
DS-1 Max. Velocity	1.22	0.050	0.07	1.51
RD-1 Max. Depth	6.34	0.008	1.14	2.43
RD-1 Max. Velocity	6.34	0.170	0.88	6.91
RD-2 Max. Depth	0.38	0.005	0.08	0.56
RD-2 Max. Velocity	0.38	0.050	0.04	1.13
RD-3 Max. Depth	1.13	0.030	0.11	1.64
RD-3 Max. Velocity	1.13	0.330	0.05	3.43
UB-1 Max. Depth	0.10	0.025	0.14	1.13
UB-1 Max. Velocity	0.10	0.150	0.10	2.21
UB-2 Max. Depth	0.11	0.025	0.15	1.16
UB-2 Max. Velocity	0.11	0.150	0.11	2.26
UD-1 Max. Depth	4.06	0.008	0.97	2.17
UD-1 Max. Velocity	4.06	0.170	0.57	6.18

25-year, 6-hour Event

Label	Discharge (cfs)	Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
SPO-1 Max. Depth	4.84	0.100	0.20	3.81
SPO-1 Max. Velocity	4.84	0.330	0.14	5.53
SPO-2 Max. Depth	7.42	0.050	0.39	3.94
SPO-2 Max. Velocity	7.42	0.500	0.20	8.39



Routing Diagram for 100yr-6hr Operational
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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment DW-1:

Runoff = 1.18 cfs @ 2.90 hrs, Volume= 0.033 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.535	86	Newly graded area, HSG B
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	90	0.5000	2.80		Lag/CN Method,

Summary for Subcatchment DW-10:

Runoff = 0.67 cfs @ 2.90 hrs, Volume= 0.019 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.303	86	Newly graded area, HSG B
0.303		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	60	0.1900	1.59		Lag/CN Method,

Summary for Subcatchment DW-2:

Runoff = 4.74 cfs @ 2.94 hrs, Volume= 0.139 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
2.270	86	Newly graded area, HSG B
2.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	285	0.0880	1.48		Lag/CN Method,

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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment DW-3:

Runoff = 11.70 cfs @ 2.94 hrs, Volume= 0.340 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
5.527	86	Newly graded area, HSG B
5.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	340	0.2000	2.31		Lag/CN Method,

Summary for Subcatchment DW-4:

Runoff = 12.82 cfs @ 2.94 hrs, Volume= 0.374 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
6.083	86	Newly graded area, HSG B
6.083		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	380	0.1900	2.30		Lag/CN Method,

Summary for Subcatchment DW-5:

Runoff = 8.80 cfs @ 2.98 hrs, Volume= 0.288 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
4.686	86	Newly graded area, HSG B
4.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	820	0.1500	2.39		Lag/CN Method,

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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment DW-6:

Runoff = 1.35 cfs @ 2.91 hrs, Volume= 0.038 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.626	86	Newly graded area, HSG B
0.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	190	0.5000	3.25		Lag/CN Method,

Summary for Subcatchment DW-7:

Runoff = 2.48 cfs @ 2.89 hrs, Volume= 0.082 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.606	98	Water Surface, HSG B
0.606		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Subcatchment DW-8:

Runoff = 0.46 cfs @ 2.90 hrs, Volume= 0.013 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.207	86	Newly graded area, HSG B
0.207		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	20	0.3300	1.68		Lag/CN Method,

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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment DW-9:

Runoff = 2.47 cfs @ 2.89 hrs, Volume= 0.082 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.604	98	Water Surface, HSG B
0.604		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Subcatchment UW-1:

Runoff = 2.56 cfs @ 3.48 hrs, Volume= 0.309 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 17.785	71	Pinyon/juniper range, Poor, HSG B
17.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	1,760	0.0300	0.78		Lag/CN Method,

Summary for Subcatchment UW-2:

Runoff = 0.07 cfs @ 2.95 hrs, Volume= 0.002 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 0.135	71	Pinyon/juniper range, Poor, HSG B
0.135		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.3000	1.51		Lag/CN Method,

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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment UW-3:

Runoff = 0.08 cfs @ 2.95 hrs, Volume= 0.002 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 0.143	71	Pinyon/juniper range, Poor, HSG B
0.143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	150	0.2000	1.24		Lag/CN Method,

Summary for Reach DD-1:

Inflow Area = 0.535 ac, 0.00% Impervious, Inflow Depth = 0.74"
 Inflow = 1.18 cfs @ 2.90 hrs, Volume= 0.033 af
 Outflow = 1.01 cfs @ 2.99 hrs, Volume= 0.033 af, Atten= 14%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.24 fps, Min. Travel Time= 2.9 min
 Avg. Velocity = 0.85 fps, Avg. Travel Time= 7.5 min

Peak Storage= 176 cf @ 2.94 hrs
 Average Depth at Peak Storage= 0.48'
 Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 7.34 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 2.0 ' Top Width= 4.00'
 Length= 385.0' Slope= 0.0286 ' / '
 Inlet Invert= 5,949.00', Outlet Invert= 5,938.00'

**Summary for Reach DD-2:**

Inflow Area = 2.270 ac, 0.00% Impervious, Inflow Depth = 0.74"
 Inflow = 4.74 cfs @ 2.94 hrs, Volume= 0.139 af
 Outflow = 4.17 cfs @ 3.00 hrs, Volume= 0.139 af, Atten= 12%, Lag= 3.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Max. Velocity= 5.04 fps, Min. Travel Time= 1.8 min
 Avg. Velocity = 1.96 fps, Avg. Travel Time= 4.7 min

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Type II 6-hr Rainfall=1.85"

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Peak Storage= 475 cf @ 2.96 hrs

Average Depth at Peak Storage= 0.76'

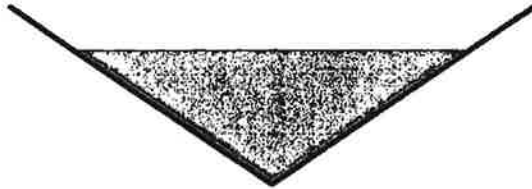
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 9.13 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 1.5 ' / ' Top Width= 3.00'

Length= 550.0' Slope= 0.0864 ' / '

Inlet Invert= 5,985.00', Outlet Invert= 5,937.50'

**Summary for Reach DD-3:**

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth = 0.74"

Inflow = 17.08 cfs @ 2.95 hrs, Volume= 0.546 af

Outflow = 12.12 cfs @ 3.12 hrs, Volume= 0.546 af, Atten= 29%, Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.03 fps, Min. Travel Time= 6.6 min

Avg. Velocity = 0.87 fps, Avg. Travel Time= 22.9 min

Peak Storage= 4,927 cf @ 3.01 hrs

Average Depth at Peak Storage= 1.17'

Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 94.24 cfs

0.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 3.0 ' / ' Top Width= 15.00'

Length= 1,200.0' Slope= 0.0146 ' / '

Inlet Invert= 5,937.50', Outlet Invert= 5,920.00'

**Summary for Reach DD-4:**

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth = 0.74"

Inflow = 12.12 cfs @ 3.12 hrs, Volume= 0.546 af

Outflow = 11.83 cfs @ 3.13 hrs, Volume= 0.546 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 6.71 fps, Min. Travel Time= 0.5 min

Avg. Velocity = 1.68 fps, Avg. Travel Time= 1.8 min

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Type II 6-hr Rainfall=1.85"

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Peak Storage= 330 cf @ 3.12 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 171.61 cfs

8.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 ' Top Width= 12.00'
Length= 185.0' Slope= 0.2865 ' '
Inlet Invert= 5,920.00', Outlet Invert= 5,867.00'



Summary for Reach DD-5:

Inflow Area = 5.527 ac, 0.00% Impervious, Inflow Depth = 0.74"
Inflow = 11.70 cfs @ 2.94 hrs, Volume= 0.340 af
Outflow = 9.12 cfs @ 3.04 hrs, Volume= 0.340 af, Atten= 22%, Lag= 6.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.31 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 12.8 min

Peak Storage= 2,351 cf @ 2.98 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 158.49 cfs

0.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 ' Top Width= 12.00'
Length= 1,080.0' Slope= 0.0380 ' '
Inlet Invert= 5,949.00', Outlet Invert= 5,908.00'



Summary for Reach DD-6:

Inflow Area = 5.527 ac, 0.00% Impervious, Inflow Depth = 0.74"
Inflow = 9.12 cfs @ 3.04 hrs, Volume= 0.340 af
Outflow = 8.97 cfs @ 3.05 hrs, Volume= 0.340 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.00 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 1.0 min

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Peak Storage= 182 cf @ 3.05 hrs

Average Depth at Peak Storage= 0.87'

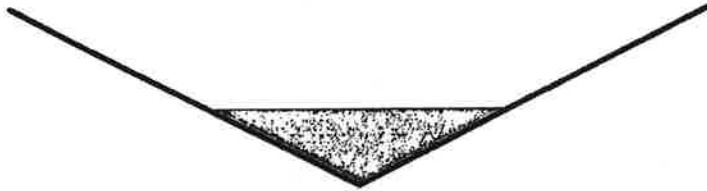
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 83.53 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 ' / ' Top Width= 8.00'

Length= 120.0' Slope= 0.0917 ' / '

Inlet Invert= 5,908.00', Outlet Invert= 5,897.00'

**Summary for Reach DS-1:**

Inflow Area = 0.535 ac, 0.00% Impervious, Inflow Depth = 0.74"

Inflow = 1.01 cfs @ 2.99 hrs, Volume= 0.033 af

Outflow = 1.00 cfs @ 2.99 hrs, Volume= 0.033 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.03 fps, Min. Travel Time= 0.3 min

Avg. Velocity = 0.32 fps, Avg. Travel Time= 1.1 min

Peak Storage= 20 cf @ 2.99 hrs

Average Depth at Peak Storage= 0.08'

Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 28.22 cfs

10.00' x 0.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 20.0 ' / ' Top Width= 30.00'

Length= 20.0' Slope= 0.0250 ' / '

Inlet Invert= 5,938.00', Outlet Invert= 5,937.50'

**Summary for Reach UB-1:**

Inflow Area = 0.135 ac, 0.00% Impervious, Inflow Depth = 0.21"

Inflow = 0.07 cfs @ 2.95 hrs, Volume= 0.002 af

Outflow = 0.07 cfs @ 2.96 hrs, Volume= 0.002 af, Atten= 7%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.15 fps, Min. Travel Time= 0.5 min

Avg. Velocity = 1.19 fps, Avg. Travel Time= 0.8 min

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Peak Storage= 2 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 3.56 cfs

0.00' x 0.50' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 60.0' Slope= 0.0500 '/'
Inlet Invert= 5,875.00', Outlet Invert= 5,872.00'

**Summary for Reach UB-2:**

Inflow Area = 0.143 ac, 0.00% Impervious, Inflow Depth = 0.21"
Inflow = 0.08 cfs @ 2.95 hrs, Volume= 0.002 af
Outflow = 0.07 cfs @ 2.97 hrs, Volume= 0.002 af, Atten= 12%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.11 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 1.2 min

Peak Storage= 3 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 3.45 cfs

0.00' x 0.50' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 85.0' Slope= 0.0471 '/'
Inlet Invert= 5,876.00', Outlet Invert= 5,872.00'

**Summary for Reach UD-1:**

Inflow Area = 17.785 ac, 0.00% Impervious, Inflow Depth = 0.21"
Inflow = 2.56 cfs @ 3.48 hrs, Volume= 0.309 af
Outflow = 2.48 cfs @ 3.65 hrs, Volume= 0.309 af, Atten= 3%, Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.51 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 1.59 fps, Avg. Travel Time= 12.1 min

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Peak Storage= 814 cf @ 3.56 hrs

Average Depth at Peak Storage= 0.60'

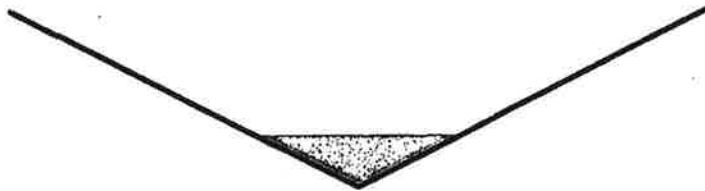
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 63.02 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 '1' Top Width= 8.00'

Length= 1,150.0' Slope= 0.0522 '1'

Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'

**Summary for Pond SP-1:**

Inflow Area = 7.060 ac, 8.56% Impervious, Inflow Depth = 0.81"

Inflow = 9.56 cfs @ 3.05 hrs, Volume= 0.478 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Peak Elev= 5,897.03' @ 12.00 hrs Surf.Area= 13,647 sf Storage= 20,840 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	114,498 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0	0
5,895.00	4,583	1,146	1,146
5,896.00	10,205	7,394	8,540
5,897.00	13,585	11,895	20,435
5,898.00	15,653	14,619	35,054
5,899.00	17,740	16,697	51,750
5,900.00	19,849	18,795	70,545
5,901.00	21,972	20,911	91,455
5,902.00	24,114	23,043	114,498

Summary for Pond SP-2:

Inflow Area = 14.387 ac, 4.21% Impervious, Inflow Depth = 0.77"

Inflow = 14.37 cfs @ 3.10 hrs, Volume= 0.929 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

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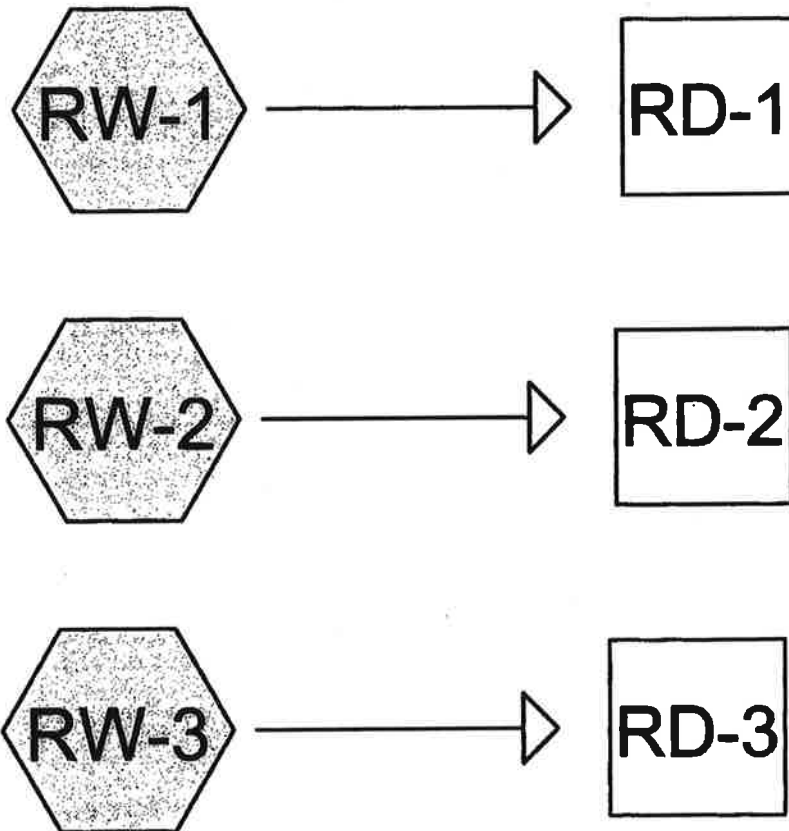
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Peak Elev= 5,863.56' @ 12.00 hrs Surf.Area= 16,078 sf Storage= 40,452 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	113,184 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0	0
5,860.00	6,718	336	336
5,861.00	9,106	7,912	8,248
5,862.00	11,806	10,456	18,704
5,863.00	14,494	13,150	31,854
5,864.00	17,310	15,902	47,756
5,865.00	20,258	18,784	66,540
5,866.00	23,302	21,780	88,320
5,866.25	24,092	5,924	94,244
5,867.00	26,413	18,939	113,184



Routing Diagram for 100yr-6hr Reclamation
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Type II 6-hr Rainfall=1.85"

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Summary for Subcatchment RW-1:

Runoff = 3.90 cfs @ 3.30 hrs, Volume= 0.377 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 21.689	71	Pinyon/juniper range, Poor, HSG B
21.689		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.6	1,150	0.0300	0.72		Lag/CN Method,

Summary for Subcatchment RW-2:

Runoff = 0.28 cfs @ 2.94 hrs, Volume= 0.009 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 0.512	71	Pinyon/juniper range, Poor, HSG B
0.512		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	120	0.5000	1.87		Lag/CN Method,

Summary for Subcatchment RW-3:

Runoff = 0.77 cfs @ 2.97 hrs, Volume= 0.027 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.85"

Area (ac)	CN	Description
* 1.540	71	Pinyon/juniper range, Poor, HSG B
1.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	330	0.2850	1.73		Lag/CN Method,

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Type II 6-hr Rainfall=1.85"

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Summary for Reach RD-1:

Inflow Area = 21.689 ac, 0.00% Impervious, Inflow Depth = 0.21"
Inflow = 3.90 cfs @ 3.30 hrs, Volume= 0.377 af
Outflow = 3.67 cfs @ 3.46 hrs, Volume= 0.377 af, Atten= 6%, Lag= 9.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.87 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 1.65 fps, Avg. Travel Time= 11.6 min

Peak Storage= 1,097 cf @ 3.37 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 63.02 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '1' Top Width= 8.00'
Length= 1,150.0' Slope= 0.0522 '1'
Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'



Summary for Reach RD-2:

Inflow Area = 0.512 ac, 0.00% Impervious, Inflow Depth = 0.21"
Inflow = 0.28 cfs @ 2.94 hrs, Volume= 0.009 af
Outflow = 0.21 cfs @ 3.03 hrs, Volume= 0.009 af, Atten= 23%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.55 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 5.2 min

Peak Storage= 40 cf @ 2.97 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 145.64 cfs

8.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 3.0 '1' Top Width= 20.00'
Length= 100.0' Slope= 0.0100 '1'
Inlet Invert= 5,931.00', Outlet Invert= 5,930.00'



100yr-6hr Reclamation

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Type II 6-hr Rainfall=1.85"

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Summary for Reach RD-3:

Inflow Area = 1.540 ac, 0.00% Impervious, Inflow Depth = 0.21"
Inflow = 0.77 cfs @ 2.97 hrs, Volume= 0.027 af
Outflow = 0.70 cfs @ 3.00 hrs, Volume= 0.027 af, Atten= 10%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.39 fps, Min. Travel Time= 1.0 min

Avg. Velocity = 1.33 fps, Avg. Travel Time= 1.8 min

Peak Storage= 43 cf @ 2.99 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 424.60 cfs

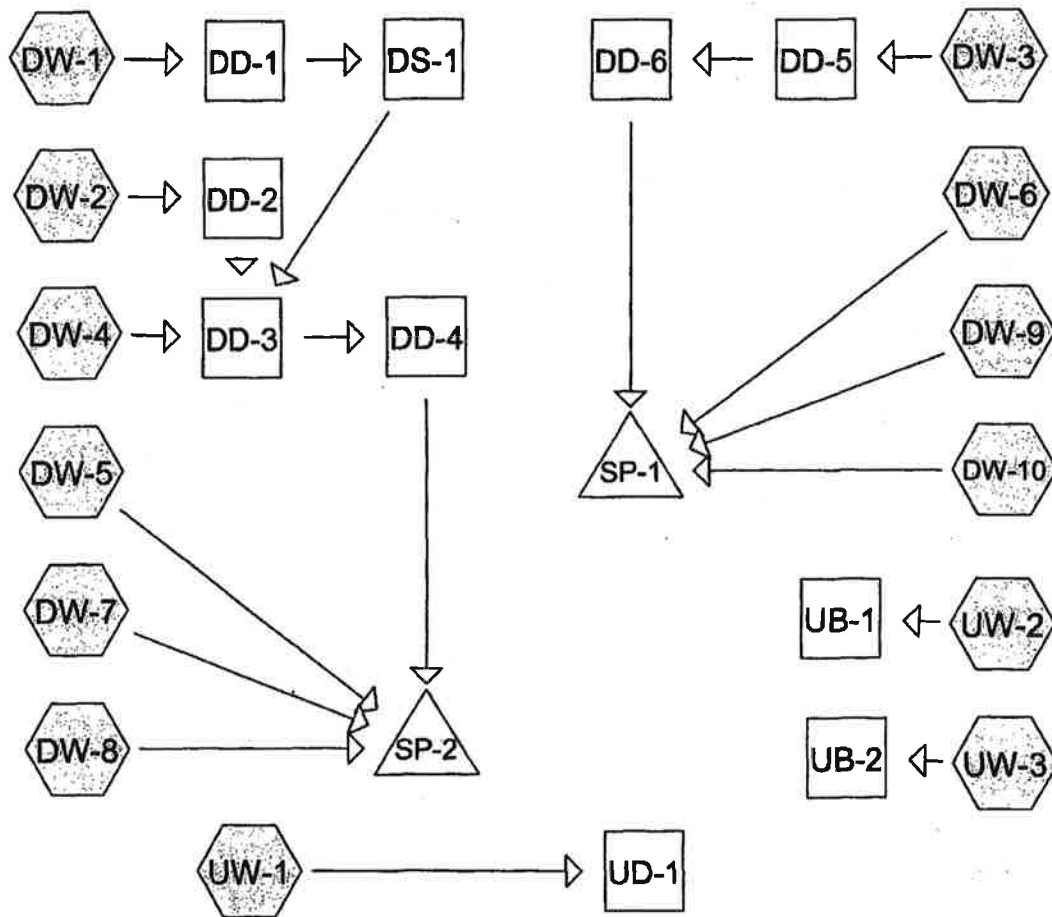
6.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 '/' Top Width= 14.00'

Length= 140.0' Slope= 0.2214 '/'

Inlet Invert= 5,902.00', Outlet Invert= 5,871.00'





Routing Diagram for 100yr-24hr Operational
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100yr-24hr Operational

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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment DW-1:

Runoff = 1.22 cfs @ 11.90 hrs, Volume= 0.050 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.535	86	Newly graded area, HSG B
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	90	0.5000	2.80		Lag/CN Method,

Summary for Subcatchment DW-10:

Runoff = 0.69 cfs @ 11.90 hrs, Volume= 0.028 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.303	86	Newly graded area, HSG B
0.303		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	60	0.1900	1.59		Lag/CN Method,

Summary for Subcatchment DW-2:

Runoff = 4.91 cfs @ 11.94 hrs, Volume= 0.212 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
2.270	86	Newly graded area, HSG B
2.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	285	0.0880	1.48		Lag/CN Method,

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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment DW-3:

Runoff = 12.06 cfs @ 11.93 hrs, Volume= 0.517 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
5.527	86	Newly graded area, HSG B
5.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	340	0.2000	2.31		Lag/CN Method,

Summary for Subcatchment DW-4:

Runoff = 13.25 cfs @ 11.94 hrs, Volume= 0.569 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
6.083	86	Newly graded area, HSG B
6.083		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	380	0.1900	2.30		Lag/CN Method,

Summary for Subcatchment DW-5:

Runoff = 9.18 cfs @ 11.97 hrs, Volume= 0.438 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
4.686	86	Newly graded area, HSG B
4.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	820	0.1500	2.39		Lag/CN Method,

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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment DW-6:

Runoff = 1.40 cfs @ 11.90 hrs, Volume= 0.059 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.626	86	Newly graded area, HSG B
0.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	190	0.5000	3.25		Lag/CN Method,

Summary for Subcatchment DW-7:

Runoff = 2.25 cfs @ 11.89 hrs, Volume= 0.107 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.606	98	Water Surface, HSG B
0.606		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Subcatchment DW-8:

Runoff = 0.48 cfs @ 11.90 hrs, Volume= 0.019 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.207	86	Newly graded area, HSG B
0.207		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	20	0.3300	1.68		Lag/CN Method,

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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment DW-9:

Runoff = 2.24 cfs @ 11.89 hrs, Volume= 0.107 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
0.604	98	Water Surface, HSG B
0.604		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Subcatchment UW-1:

Runoff = 4.06 cfs @ 12.41 hrs, Volume= 0.610 af, Depth> 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 17.785	71	Pinyon/juniper range, Poor, HSG B
17.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	1,760	0.0300	0.78		Lag/CN Method,

Summary for Subcatchment UW-2:

Runoff = 0.10 cfs @ 11.94 hrs, Volume= 0.005 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 0.135	71	Pinyon/juniper range, Poor, HSG B
0.135		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.3000	1.51		Lag/CN Method,

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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment UW-3:

Runoff = 0.11 cfs @ 11.94 hrs, Volume= 0.005 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 0.143	71	Pinyon/Juniper range, Poor, HSG B
0.143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	150	0.2000	1.24		Lag/CN Method,

Summary for Reach DD-1:

Inflow Area = 0.535 ac, 0.00% Impervious, Inflow Depth > 1.12"
 Inflow = 1.22 cfs @ 11.90 hrs, Volume= 0.050 af
 Outflow = 1.06 cfs @ 11.98 hrs, Volume= 0.050 af, Atten= 13%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.25 fps, Min. Travel Time= 2.8 min
 Avg. Velocity = 0.85 fps, Avg. Travel Time= 7.5 min

Peak Storage= 182 cf @ 11.93 hrs
 Average Depth at Peak Storage= 0.49'
 Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 7.34 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 2.0 ' Top Width= 4.00'
 Length= 385.0' Slope= 0.0286 '/
 Inlet Invert= 5,949.00', Outlet Invert= 5,938.00'

**Summary for Reach DD-2:**

Inflow Area = 2.270 ac, 0.00% Impervious, Inflow Depth > 1.12"
 Inflow = 4.91 cfs @ 11.94 hrs, Volume= 0.212 af
 Outflow = 4.38 cfs @ 11.99 hrs, Volume= 0.212 af, Atten= 11%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Max. Velocity= 5.12 fps, Min. Travel Time= 1.8 min
 Avg. Velocity = 1.91 fps, Avg. Travel Time= 4.8 min

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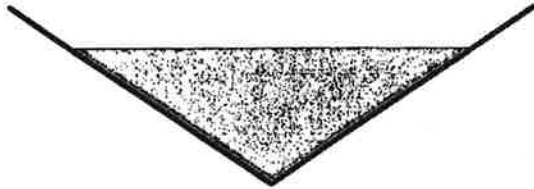
Type II 24-hr Rainfall=2.35"

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Peak Storage= 492 cf @ 11.96 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 9.13 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 550.0' Slope= 0.0864 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,937.50'



Summary for Reach DD-3:

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth > 1.12"
Inflow = 17.93 cfs @ 11.94 hrs, Volume= 0.830 af
Outflow = 13.54 cfs @ 12.11 hrs, Volume= 0.824 af, Atten= 25%, Lag= 9.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.11 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 16.2 min

Peak Storage= 5,312 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.21'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 94.24 cfs

0.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 1,200.0' Slope= 0.0146 '/'
Inlet Invert= 5,937.50', Outlet Invert= 5,920.00'



Summary for Reach DD-4:

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth > 1.11"
Inflow = 13.54 cfs @ 12.11 hrs, Volume= 0.824 af
Outflow = 13.30 cfs @ 12.12 hrs, Volume= 0.823 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.06 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.83 fps, Avg. Travel Time= 1.7 min

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Type II 24-hr Rainfall=2.35"

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Peak Storage= 354 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 171.61 cfs

8.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 185.0' Slope= 0.2865 '/'
Inlet Invert= 5,920.00', Outlet Invert= 5,867.00'

**Summary for Reach DD-5:**

Inflow Area = 5.527 ac, 0.00% Impervious, Inflow Depth > 1.12"
Inflow = 12.06 cfs @ 11.93 hrs, Volume= 0.517 af
Outflow = 9.77 cfs @ 12.03 hrs, Volume= 0.514 af, Atten= 19%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.41 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 1.69 fps, Avg. Travel Time= 10.7 min

Peak Storage= 2,471 cf @ 11.97 hrs
Average Depth at Peak Storage= 1.07'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 158.49 cfs

0.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 1,080.0' Slope= 0.0380 '/'
Inlet Invert= 5,949.00', Outlet Invert= 5,908.00'

**Summary for Reach DD-6:**

Inflow Area = 5.527 ac, 0.00% Impervious, Inflow Depth > 1.12"
Inflow = 9.77 cfs @ 12.03 hrs, Volume= 0.514 af
Outflow = 9.64 cfs @ 12.04 hrs, Volume= 0.514 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.10 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.35 fps, Avg. Travel Time= 0.8 min

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Type II 24-hr Rainfall=2.35"

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Peak Storage= 192 cf @ 12.04 hrs

Average Depth at Peak Storage= 0.89'

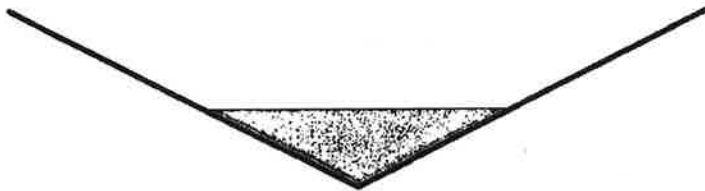
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 83.53 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 '/' Top Width= 8.00'

Length= 120.0' Slope= 0.0917 '/'

Inlet Invert= 5,908.00', Outlet Invert= 5,897.00'

**Summary for Reach DS-1:**

Inflow Area = 0.535 ac, 0.00% Impervious, Inflow Depth > 1.12"

Inflow = 1.06 cfs @ 11.98 hrs, Volume= 0.050 af

Outflow = 1.05 cfs @ 11.99 hrs, Volume= 0.050 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.04 fps, Min. Travel Time= 0.3 min

Avg. Velocity = 0.26 fps, Avg. Travel Time= 1.3 min

Peak Storage= 20 cf @ 11.98 hrs

Average Depth at Peak Storage= 0.09'

Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 28.22 cfs

10.00' x 0.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 20.0 '/' Top Width= 30.00'

Length= 20.0' Slope= 0.0250 '/'

Inlet Invert= 5,938.00', Outlet Invert= 5,937.50'

**Summary for Reach UB-1:**

Inflow Area = 0.135 ac, 0.00% Impervious, Inflow Depth > 0.42"

Inflow = 0.10 cfs @ 11.94 hrs, Volume= 0.005 af

Outflow = 0.10 cfs @ 11.95 hrs, Volume= 0.005 af, Atten= 4%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.34 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 0.99 fps, Avg. Travel Time= 1.0 min

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Type II 24-hr Rainfall=2.35"

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Peak Storage= 3 cf @ 11.94 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 3.56 cfs

0.00' x 0.50' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 ' / ' Top Width= 2.50'
Length= 60.0' Slope= 0.0500 ' / '
Inlet Invert= 5,875.00', Outlet Invert= 5,872.00'

**Summary for Reach UB-2:**

Inflow Area = 0.143 ac, 0.00% Impervious, Inflow Depth > 0.42"
Inflow = 0.11 cfs @ 11.94 hrs, Volume= 0.005 af
Outflow = 0.10 cfs @ 11.95 hrs, Volume= 0.005 af, Atten= 6%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.31 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 1.4 min

Peak Storage= 4 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 3.45 cfs

0.00' x 0.50' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 ' / ' Top Width= 2.50'
Length= 85.0' Slope= 0.0471 ' / '
Inlet Invert= 5,876.00', Outlet Invert= 5,872.00'

**Summary for Reach UD-1:**

Inflow Area = 17.785 ac, 0.00% Impervious, Inflow Depth > 0.41"
Inflow = 4.06 cfs @ 12.41 hrs, Volume= 0.610 af
Outflow = 3.93 cfs @ 12.56 hrs, Volume= 0.605 af, Atten= 3%, Lag= 9.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.94 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 8.4 min

100yr-24hr Operational

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Type II 24-hr Rainfall=2.35"

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Peak Storage= 1,151 cf @ 12.48 hrs

Average Depth at Peak Storage= 0.71'

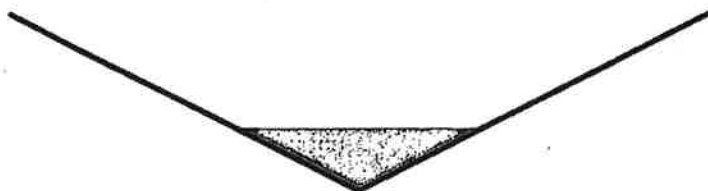
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 63.02 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 ' Top Width= 8.00'

Length= 1,150.0' Slope= 0.0522 ' /'

Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'

**Summary for Pond SP-1:**

Inflow Area = 7.060 ac, 8.56% Impervious, Inflow Depth > 1.20"

Inflow = 10.27 cfs @ 12.04 hrs, Volume= 0.708 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 5,897.72' @ 24.00 hrs Surf.Area= 15,081 sf Storage= 30,806 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	114,498 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0	0
5,895.00	4,583	1,146	1,146
5,896.00	10,205	7,394	8,540
5,897.00	13,585	11,895	20,435
5,898.00	15,653	14,619	35,054
5,899.00	17,740	16,697	51,750
5,900.00	19,849	18,795	70,545
5,901.00	21,972	20,911	91,455
5,902.00	24,114	23,043	114,498

Summary for Pond SP-2:

Inflow Area = 14.387 ac, 4.21% Impervious, Inflow Depth > 1.16"

Inflow = 16.64 cfs @ 12.02 hrs, Volume= 1.387 af

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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Type II 24-hr Rainfall=2.35"

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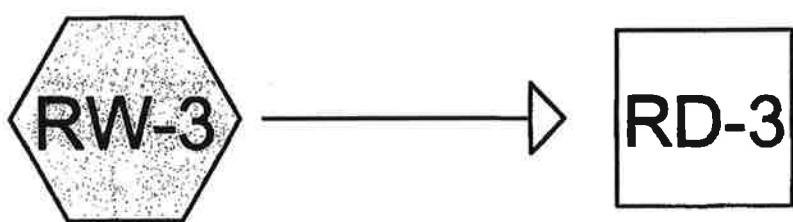
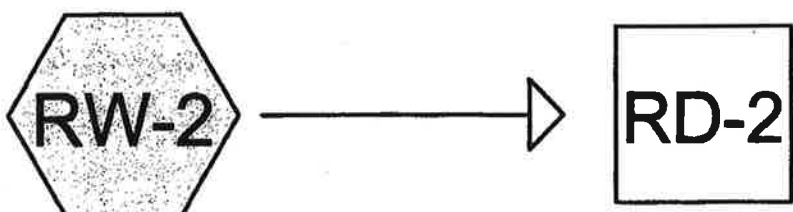
Peak Elev= 5,864.69' @ 24.00 hrs Surf.Area= 19,343 sf Storage= 60,392 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	113,186 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0	0
5,860.00	6,718	336	336
5,861.00	9,106	7,912	8,248
5,862.00	11,806	10,456	18,704
5,863.00	14,494	13,150	31,854
5,864.00	17,310	15,902	47,756
5,865.00	20,258	18,784	66,540
5,866.00	23,306	21,782	88,322
5,866.25	24,092	5,925	94,247
5,867.00	26,413	18,939	113,186



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Type II 24-hr Rainfall=2.35"

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Summary for Subcatchment RW-1:

Runoff = 6.34 cfs @ 12.26 hrs, Volume= 0.748 af, Depth> 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 21.689	71	Pinyon/juniper range, Poor, HSG B
21.689		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.6	1,150	0.0300	0.72		Lag/CN Method,

Summary for Subcatchment RW-2:

Runoff = 0.38 cfs @ 11.92 hrs, Volume= 0.018 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 0.512	71	Pinyon/juniper range, Poor, HSG B
0.512		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	120	0.5000	1.87		Lag/CN Method,

Summary for Subcatchment RW-3:

Runoff = 1.13 cfs @ 11.95 hrs, Volume= 0.054 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type II 24-hr Rainfall=2.35"

Area (ac)	CN	Description
* 1.540	71	Pinyon/juniper range, Poor, HSG B
1.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	330	0.2850	1.73		Lag/CN Method,

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Type II 24-hr Rainfall=2.35"

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Summary for Reach RD-1:

Inflow Area = 21.689 ac, 0.00% Impervious, Inflow Depth > 0.41"
Inflow = 6.34 cfs @ 12.26 hrs, Volume= 0.748 af
Outflow = 5.99 cfs @ 12.39 hrs, Volume= 0.742 af, Atten= 6%, Lag= 8.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.38 fps, Min. Travel Time= 4.4 min

Avg. Velocity = 2.39 fps, Avg. Travel Time= 8.0 min

Peak Storage= 1,586 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.83'

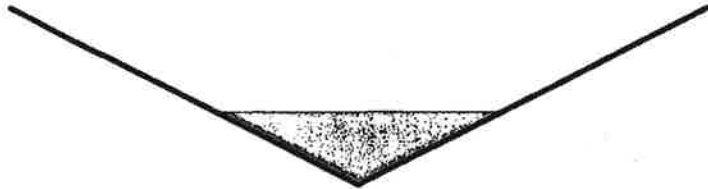
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 63.02 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 '1' Top Width= 8.00'

Length= 1,150.0' Slope= 0.0522 '1'

Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'

**Summary for Reach RD-2:**

Inflow Area = 0.512 ac, 0.00% Impervious, Inflow Depth > 0.42"
Inflow = 0.38 cfs @ 11.92 hrs, Volume= 0.018 af
Outflow = 0.34 cfs @ 12.00 hrs, Volume= 0.018 af, Atten= 11%, Lag= 4.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.67 fps, Min. Travel Time= 2.5 min

Avg. Velocity = 0.32 fps, Avg. Travel Time= 5.3 min

Peak Storage= 53 cf @ 11.95 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 145.64 cfs

8.00' x 2.00' deep channel, n= 0.035

Side Slope Z-value= 3.0 '1' Top Width= 20.00'

Length= 100.0' Slope= 0.0100 '1'

Inlet Invert= 5,931.00', Outlet Invert= 5,930.00'



‡

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Summary for Reach RD-3:

Inflow Area = 1.540 ac, 0.00% Impervious, Inflow Depth > 0.42"
Inflow = 1.13 cfs @ 11.95 hrs, Volume= 0.054 af
Outflow = 1.02 cfs @ 11.98 hrs, Volume= 0.054 af, Atten= 9%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.75 fps, Min. Travel Time= 0.8 min

Avg. Velocity= 1.30 fps, Avg. Travel Time= 1.8 min

Peak Storage= 55 cf @ 11.96 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 424.60 cfs

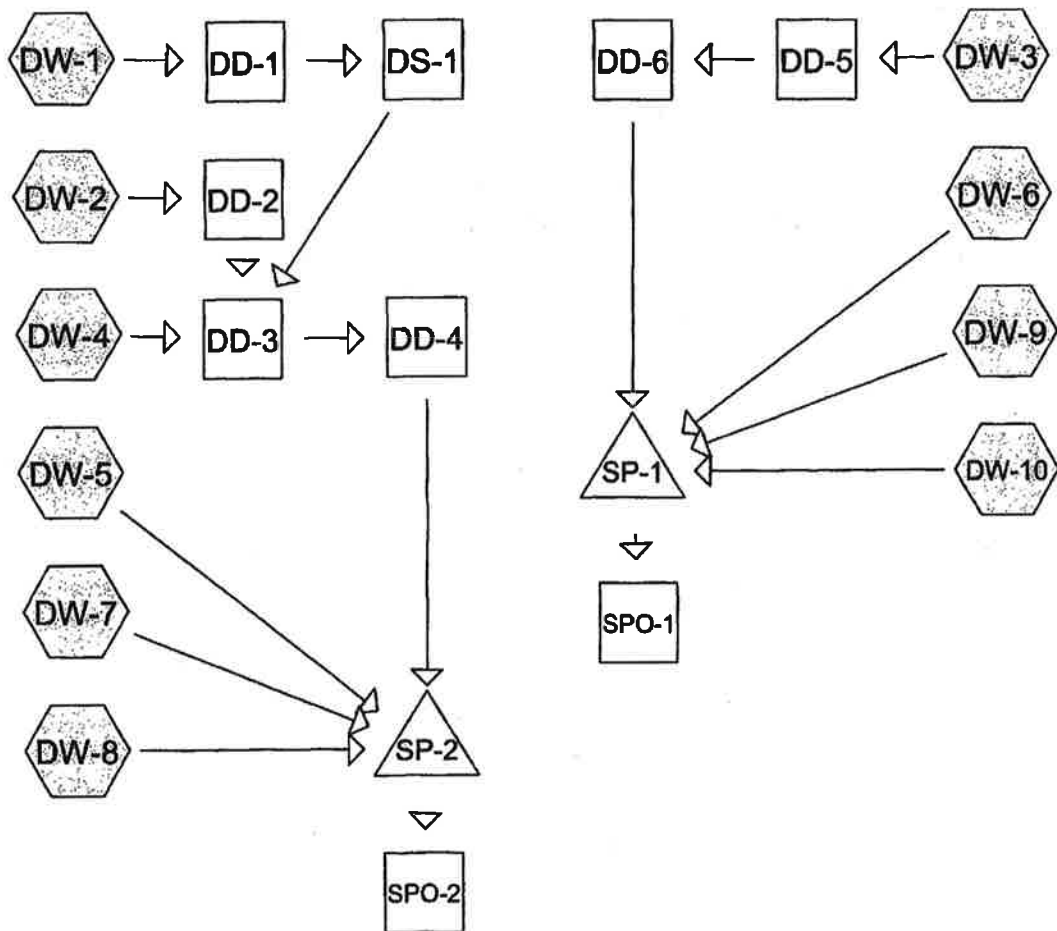
6.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 '/' Top Width= 14.00'

Length= 140.0' Slope= 0.2214 '/'

Inlet Invert= 5,902.00', Outlet Invert= 5,871.00'





Routing Diagram for 25yr-6hr Operational
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25yr-6hr Operational

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Type II 6-hr Rainfall=1.38"

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Summary for Subcatchment DW-1:

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.67 cfs @ 2.91 hrs, Volume= 0.018 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs
 Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.535	86	Newly graded area, HSG B
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	90	0.5000	2.80		Lag/CN Method,

Summary for Subcatchment DW-10:

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.38 cfs @ 2.91 hrs, Volume= 0.010 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs
 Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.303	86	Newly graded area, HSG B
0.303		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	60	0.1900	1.59		Lag/CN Method,

Summary for Subcatchment DW-2:

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 2.68 cfs @ 2.95 hrs, Volume= 0.078 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs
 Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
2.270	86	Newly graded area, HSG B
2.270		100.00% Pervious Area

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Type II 6-hr Rainfall=1.38"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	285	0.0880	1.48		Lag/CN Method,

Summary for Subcatchment DW-3:[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 6.65 cfs @ 2.94 hrs, Volume= 0.191 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs

Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
5.527	86	Newly graded area, HSG B
5.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	340	0.2000	2.31		Lag/CN Method,

Summary for Subcatchment DW-4:[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 7.27 cfs @ 2.94 hrs, Volume= 0.210 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs

Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
6.083	86	Newly graded area, HSG B
6.083		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	380	0.1900	2.30		Lag/CN Method,

Summary for Subcatchment DW-5:[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 5.65 cfs @ 2.94 hrs, Volume= 0.162 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, $dt=0.05$ hrs

Type II 6-hr Rainfall=1.38"

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Type II 6-hr Rainfall=1.38"

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Area (ac)	CN	Description
4.686	86	Newly graded area, HSG B
4.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	390	0.3300	3.05		Lag/CN Method,

Summary for Subcatchment DW-6:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.76 cfs @ 2.91 hrs, Volume= 0.022 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.626	86	Newly graded area, HSG B
0.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	190	0.5000	3.25		Lag/CN Method,

Summary for Subcatchment DW-7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.82 cfs @ 2.89 hrs, Volume= 0.059 af, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.606	98	Water Surface, HSG B
0.606		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Subcatchment DW-8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.26 cfs @ 2.90 hrs, Volume= 0.007 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Type II 6-hr Rainfall=1.38"

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Type II 6-hr Rainfall=1.38"

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Area (ac)	CN	Description
0.207	86	Newly graded area, HSG B
0.207		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	20	0.3300	1.68		Lag/CN Method,

Summary for Subcatchment DW-9:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.81 cfs @ 2.89 hrs, Volume= 0.059 af, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG B
0.605		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		Lag/CN Method,

Summary for Reach DD-1:

Inflow Area = 0.535 ac, 0.00% Impervious, Inflow Depth = 0.41"

Inflow = 0.67 cfs @ 2.91 hrs, Volume= 0.018 af

Outflow = 0.55 cfs @ 3.00 hrs, Volume= 0.018 af, Atten= 18%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.93 fps, Min. Travel Time= 3.3 min

Avg. Velocity= 0.77 fps, Avg. Travel Time= 8.3 min

Peak Storage= 112 cf @ 2.95 hrs

Average Depth at Peak Storage= 0.38'

Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 7.34 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 ' Top Width= 4.00'

Length= 385.0' Slope= 0.0286 ' '

Inlet Invert= 5,949.00', Outlet Invert= 5,938.00'



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Type II 6-hr Rainfall=1.38"

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Summary for Reach DD-2:

Inflow Area = 2.270 ac, 0.00% Impervious, Inflow Depth = 0.41"
Inflow = 2.68 cfs @ 2.95 hrs, Volume= 0.078 af
Outflow = 2.31 cfs @ 3.01 hrs, Volume= 0.078 af, Atten= 14%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.16 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 5.5 min

Peak Storage= 314 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 12.77 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 550.0' Slope= 0.0864 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,937.50'

**Summary for Reach DD-3:**

[62] Hint: Exceeded Reach DD-2 OUTLET depth by 0.49' @ 3.10 hrs
[63] Warning: Exceeded Reach DS-1 INLET depth by 0.33' @ 3.05 hrs

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth = 0.41"
Inflow = 9.31 cfs @ 2.95 hrs, Volume= 0.307 af
Outflow = 5.97 cfs @ 3.16 hrs, Volume= 0.307 af, Atten= 36%, Lag= 12.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 25.3 min

Peak Storage= 2,867 cf @ 3.03 hrs
Average Depth at Peak Storage= 0.89'
Bank-Full Depth= 2.50' Flow Area= 18.8 sf, Capacity= 94.24 cfs

0.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 1,200.0' Slope= 0.0146 '/'
Inlet Invert= 5,937.50', Outlet Invert= 5,920.00'

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**Summary for Reach DD-4:**

[61] Hint: Exceeded Reach DD-3 outlet invert by 0.14' @ 3.15 hrs

Inflow Area = 8.888 ac, 0.00% Impervious, Inflow Depth = 0.41"
Inflow = 5.97 cfs @ 3.16 hrs, Volume= 0.307 af
Outflow = 5.79 cfs @ 3.18 hrs, Volume= 0.307 af, Atten= 3%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 2.1 min

Peak Storage= 213 cf @ 3.17 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 171.61 cfs

8.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 185.0' Slope= 0.2865 '/'
Inlet Invert= 5,920.00', Outlet Invert= 5,867.00'

**Summary for Reach DD-5:**

Inflow Area = 5.527 ac, 0.00% Impervious, Inflow Depth = 0.41"
Inflow = 6.65 cfs @ 2.94 hrs, Volume= 0.191 af
Outflow = 4.80 cfs @ 3.07 hrs, Volume= 0.191 af, Atten= 28%, Lag= 7.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.71 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 14.2 min

Peak Storage= 1,462 cf @ 2.99 hrs
Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 158.49 cfs

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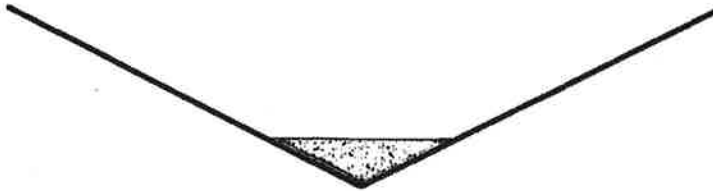
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Type II 6-hr Rainfall=1.38"

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0.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 1,080.0' Slope= 0.0380 '/'
Inlet Invert= 5,949.00', Outlet Invert= 5,908.00'



Summary for Reach DD-6:

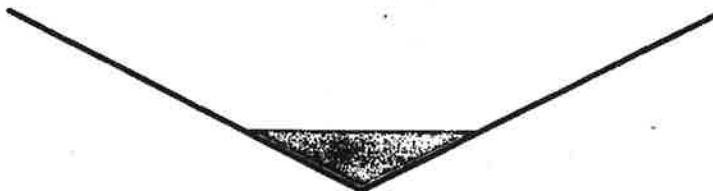
[62] Hint: Exceeded Reach DD-5 OUTLET depth by 0.05' @ 3.10 hrs

Inflow Area =	5.527 ac,	0.00% Impervious,	Inflow Depth = 0.41"
Inflow =	4.80 cfs @	3.07 hrs,	Volume= 0.191 af
Outflow =	4.68 cfs @	3.08 hrs,	Volume= 0.191 af, Atten= 3%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.06 fps, Min. Travel Time= 0.4 min
Avg. Velocity= 1.76 fps, Avg. Travel Time= 1.1 min

Peak Storage= 112 cf @ 3.07 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 83.53 cfs

0.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 120.0' Slope= 0.0917 '/'
Inlet Invert= 5,908.00', Outlet Invert= 5,897.00'



Summary for Reach DS-1:

[61] Hint: Exceeded Reach DD-1 outlet invert by 0.06' @ 3.00 hrs

Inflow Area =	0.535 ac,	0.00% Impervious,	Inflow Depth = 0.41"
Inflow =	0.55 cfs @	3.00 hrs,	Volume= 0.018 af
Outflow =	0.53 cfs @	3.01 hrs,	Volume= 0.018 af, Atten= 3%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.83 fps, Min. Travel Time= 0.4 min
Avg. Velocity= 0.28 fps, Avg. Travel Time= 1.2 min

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Peak Storage= 13 cf @ 3.00 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 28.22 cfs

10.00' x 0.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 20.0 ' Top Width= 30.00'

Length= 20.0' Slope= 0.0250 ' /'

Inlet Invert= 5,938.00', Outlet Invert= 5,937.50'



Summary for Reach SPO-1:

[78] Warning: Submerged Pond SP-1 Primary device # 1 by 0.16'

[81] Warning: Exceeded Pond SP-1 by 0.01' @ 6.05 hrs

Inflow Area = 7.061 ac, 8.57% Impervious, Inflow Depth = 0.48"

Inflow = 5.06 cfs @ 3.08 hrs, Volume= 0.282 af

Outflow = 5.00 cfs @ 3.09 hrs, Volume= 0.282 af, Atten= 1%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.96 fps, Min. Travel Time= 0.5 min

Avg. Velocity = 1.73 fps, Avg. Travel Time= 1.3 min

Peak Storage= 143 cf @ 3.09 hrs

Average Depth at Peak Storage= 0.16'

Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 424.60 cfs

6.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides

Side Slope Z-value= 2.0 ' Top Width= 14.00'

Length= 140.0' Slope= 0.2214 ' /'

Inlet Invert= 5,902.00', Outlet Invert= 5,871.00'



Summary for Reach SPO-2:

[78] Warning: Submerged Pond SP-2 Primary device # 1 by 0.19'

[81] Warning: Exceeded Pond SP-2 by 0.04' @ 3.65 hrs

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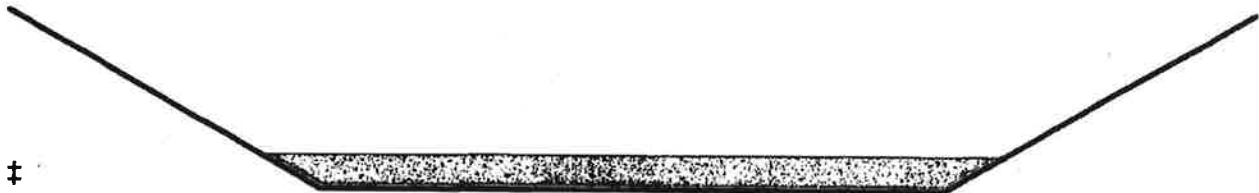
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Inflow Area = 14.387 ac, 4.21% Impervious, Inflow Depth = 0.45"
 Inflow = 7.42 cfs @ 2.93 hrs, Volume= 0.535 af
 Outflow = 7.41 cfs @ 2.93 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Max. Velocity= 8.49 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 2.43 fps, Avg. Travel Time= 0.0 min

Peak Storage= 5 cf @ 2.93 hrs
 Average Depth at Peak Storage= 0.20'
 Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 130.34 cfs

4.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 2.0 ' Top Width= 8.00'
 Length= 6.0' Slope= 0.5417 '
 Inlet Invert= 5,866.25', Outlet Invert= 5,863.00'

**Summary for Pond SP-1:**

[62] Hint: Exceeded Reach DD-6 OUTLET depth by 5.04' @ 2.70 hrs

Inflow Area = 7.061 ac, 8.57% Impervious, Inflow Depth = 0.48"
 Inflow = 5.06 cfs @ 3.08 hrs, Volume= 0.282 af
 Outflow = 5.06 cfs @ 3.08 hrs, Volume= 0.282 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.06 cfs @ 3.08 hrs, Volume= 0.282 af

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Peak Elev= 5,902.30' @ 3.08 hrs Surf.Area= 24,788 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (215.6 - 215.6)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	0 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 139,723 cf Overall x 0.0% Voids

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0	0
5,895.00	4,583	1,146	1,146
5,896.00	10,205	7,394	8,540
5,897.00	13,585	11,895	20,435
5,898.00	15,653	14,619	35,054
5,899.00	17,740	16,697	51,750
5,900.00	19,849	18,795	70,545
5,901.00	21,972	20,911	91,455
5,902.00	24,114	23,043	114,498
5,903.00	26,335	25,225	139,723

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	Special & User-Defined Head (feet) 0.00 0.29 Disch. (cfs) 0.000 4.840

Primary OutFlow Max=4.92 cfs @ 3.08 hrs HW=5,902.29' (Free Discharge)

1=Special & User-Defined (Custom Controls 4.92 cfs)

Summary for Pond SP-2:

Inflow Area = 14.387 ac, 4.21% Impervious, Inflow Depth = 0.45"
 Inflow = 7.42 cfs @ 2.93 hrs, Volume= 0.535 af
 Outflow = 7.42 cfs @ 2.93 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min
 Primary = 7.42 cfs @ 2.93 hrs, Volume= 0.535 af

Routing by Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
 Peak Elev= 5,866.45' @ 2.93 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.535 af (100% of inflow)
 Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	0 cf	Custom Stage Data Listed below 113,177 cf Overall x 0.0% Voids

Elevation (feet)	Cum.Store (cubic-feet)
5,859.90	0
5,860.00	336
5,861.00	8,248
5,862.00	18,704
5,863.00	31,854
5,864.00	47,756
5,865.00	66,540
5,866.00	88,320
5,866.25	94,247
5,867.00	113,177

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Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.25'	Special & User-Defined Head (feet) 0.00 0.20 Disch. (cfs) 0.000 7.420

Primary OutFlow Max=7.07 cfs @ 2.93 hrs HW=5,866.44' (Free Discharge)**1=Special & User-Defined (Custom Controls 7.07 cfs)**

